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the OIL AND GAS JOURNAL

PUBLISHED WEEKLY

JULY 20 1959

What idle steel plants mean to oil ▸ 39

Solution-gas-drive secrets probed ▸ 48

Contract maintenance can cut costs ▸ 68

FIRST COMPLETE REPORT:
Central Kentucky's 500-ft. drilling boom ▸ 138

Continuous R.v.p. Analyzer

Cuts Gasoline Blending Time

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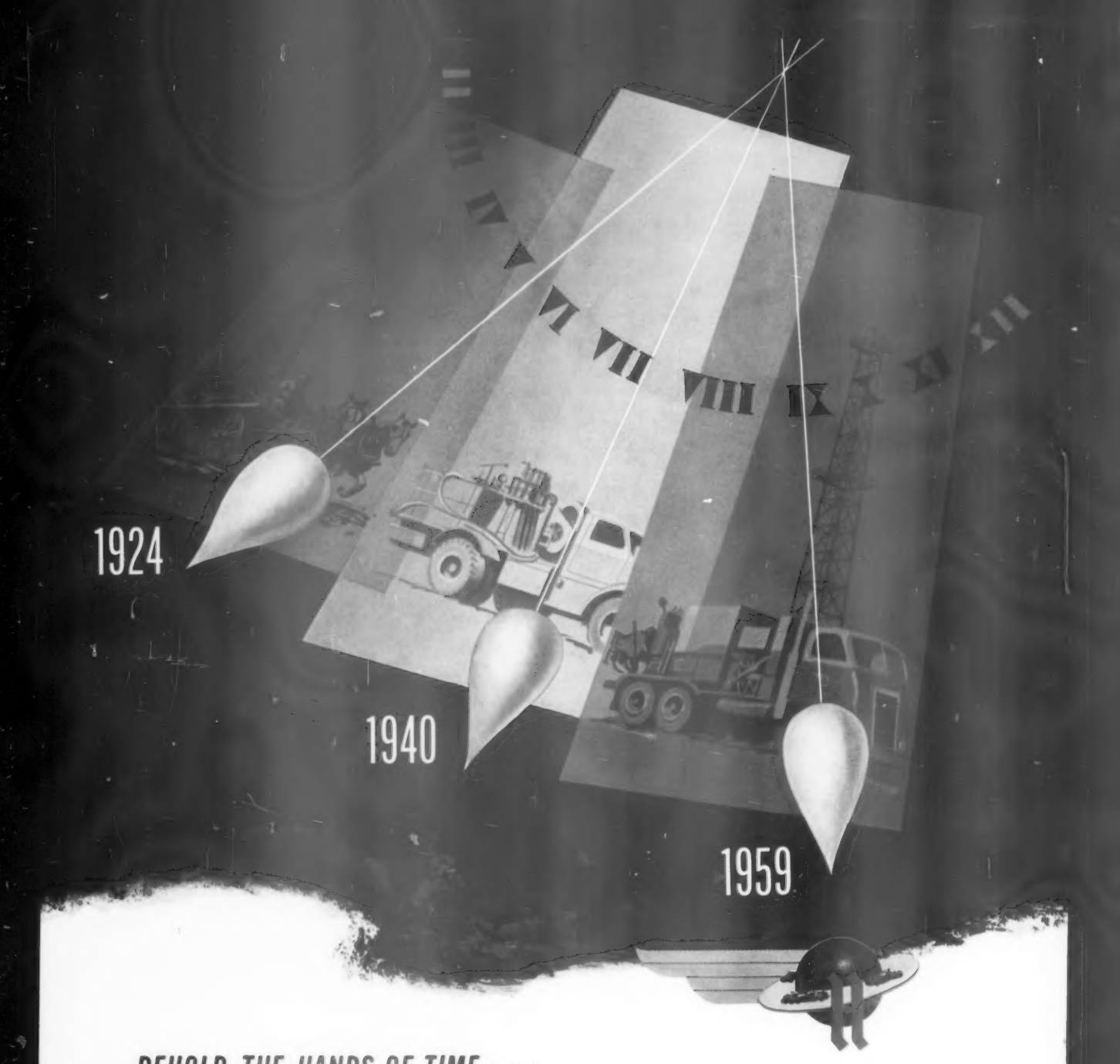

BEHOLD THE HANDS OF TIME . . .

Time is only a measure—in man, it defines the milestones of progress—Birth, growth and contributions to the community of mankind. In a company, time records not only a measure of birth and growth, but by each passing year, it reflects the position in the community of commerce that has been achieved.

Our time measure is now 35 years . . . from the early days of "Hard knocks and trial by error" to today's world wide establishment of services, equipment, products and men at the highest degree of technological knowledge.

With pardonable pride, we too, reflect on the spirit of wholesome and friendly cooperation we have enjoyed with the oil industry over this span of time. Thanks to your confidence, our 35th birthday is but a landmark on the progressive road to a more profitable future.

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 57 No. 30

Contents July 20, 1959

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The Oil and Gas Journal is published weekly with an additional issue in January by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-Class postage paid at Tulsa, Okla. Copyright 1959 by The Petroleum Publishing Co. United States and foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.

TECHNOLOGY–OPERATION

Refining-Processing:

Contract Maintenance Can Cut Costs 68
By Larry Resen

It functions primarily as a labor-supply surge drum during periods of heavy plant-maintenance requirements. When turnarounds take place and labor demands at a plant skyrocket, contract maintenance crews can step in and help.

Hydrogen Sulfide to Sulfur by Direct Oxidation 76
By Howard Grekel

Hydrogen sulfide can be selectively oxidized to sulfur without concurrent oxidation of paraffin hydrocarbons present in the gas stream. The process has been proved in the pilot plant. Investment for certain installations should be approximately 60% of that for the conventional Claus process plants.

• Continuous R.v.p. Analyzer Cuts Gasoline Blending Time in Half 82
By W. R. Foster and P. H. Richer

It also enables the refiner to sell butane as gasoline and reduce laboratory costs. R.v.p. limit can be approached much more closely, thus utilizing more butane and providing instrument payout in a matter of weeks.

Questions on Technology 89

Production:

Z Factor Determination with a Digital Computer 80
By E. H. Gray and H. L. Sims

Here is an interpolation method which requires only 400 entries for the computer to be able to reproduce the original full-size table with accuracy.

How to Interpret and Analyze Water-Flood Curtailment Data ... 92
By C. F. Weinaug

There are several mathematical techniques for curve fitting when experimental data are plotted. These techniques were used to examine data obtained in flooding a Bradford sand when water injection was temporarily interrupted. Author's conclusion: Ultimate recovery of oil was improved by the curtailment.

Drilling:

Lost Circulation and How to Prevent It 96
By John R. Eckel

Subnormal pressures and incipient fractures make the Anadarko basin bad for losing circulation of drilling fluid. This can be prevented or controlled by increasing hole size, reducing mud viscosity, limiting pipe-dropping speed, and breaking circulation every 2,500 or 3,000 ft. while going into the hole.

Air Drilling—What Does It Cost; How Successful Is It? 99
By Gordon Jackson

Figures from air drilling of 226 wells in an 18-month period show that average cost per foot was $1.37. Where no water was encountered, cost sank to $0.77 per foot.

Operators in Rockies Drill With Air 101
By Robert W. Sneed

Air has been used to drill in almost every major Rocky Mountain basin. Some 1,500 wells have been drilled with natural gas in the San Juan basin alone.

Pipelining:

Automation in Cathodic Protection, Pipelines Transmitting Data .. 72
By R. Girotti, F. Salimbeni, R. Righetti, and A. Giani

This unique system is operating successfully on short lines in Italy. Technique has long been considered in U. S., and some experiments have been made.

Results of a Study on Economics of Cathodic Protection 107
By N. K. Senatoroff

Expenditures for a carefully conceived plan of corrosion protection are the most realistic and necessary investment in construction of a gas pipeline. Cost of cathodic protection in combination with good coating is small.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
July 20, 1959

Oil industry starts out steel strike in fair shape:

Oil men report generally they have supplies on hand to last 90 days before they will have to start shutting down (p.39).

Majors have inventories that can carry most of them past 3 months. Most independents can't go past 30 days without feeling the pinch for steel.

Drilling, naturally, will feel the brunt of any long strike. When casing, tubing, drill pipe run out, new wells will stop.

Production equipment items appear in good supply.

Steel needed for projects in other divisions of the industry mostly is already on hand. New projects will just be postponed until the strike ends.

Some trends to watch: As strike goes on, steel trading and swapping will become brisk...Second-hand steel goods will become valuable...If price hike accompanies settlement of strike, look for increased swing to smaller dimension tubular goods. Slim-hole techniques really have cut sharply steel needed per foot of well...Main issue in steel strike is same as that which closed Amoco refineries at Texas City and El Dorado, Ark., and Indiana Standard's Sugar Creek plant. Labor and management are moving to a vital showdown on the issue of labor efficiency.

▼ ▼ ▼

Break in crude prices probably has been averted by Texas action in cutting back to 9 producing days for both July and August.

That's feeling among major buyers, who surprisingly report that markets are improving for both crude and products (p. 42).

The crude market currently is reported soft, particularly in the Corpus Christi area.

But this is expected to improve. Several big buyers report they'll have to go on spot market to fill needs.

Gasoline markets seem to be firmer in most areas. The

The Oil and Gas Journal is published weekly with an additional issue in January by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-Class postage paid at Tulsa, Okla. Copyright 1959 by The Petroleum Publishing Co. United States and foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.

notable exception is Minnesota where three independent refiners are in a dog fight for the gasoline market. Two sellers are down to 10.75 cents a gallon Group 3 plus pipeline charges to Minneapolis. Premium is only 2.75 cents higher.

This is situation in other areas:

...Gulf Coast—very little material available. Two refiners asking 0.25 cent a gallon over the low.

...Mississippi river—disappearance of surplus gasoline on coast has tightened up this market.

One large marketer has asked quotations on 200,000 bbl. plus of gasoline needed for general area served by Great Lakes Pipeline. And another big buyer made inter-refinery purchase in same area.

▼ ▼ ▼

Increased wave of wildcat drilling in Central Kentucky is expected in the next few months. Reason: Many good leases will start expiring unless they are drilled.

One expert predicts this will mean some highly profitable oil discoveries (p.140) in one of the nation's hottest areas.

Promising discovery may have been made by Iraq Petroleum affiliate in Abu Dhabi on the Trucial Coast.

Initial reports say the 2 Murban flowed at rate of 2,000 bbl. daily on short test from two zones. The apparent find, along with the Umm Shaif discovery in the Persian Gulf, may mean that southern Arabia is beginning to crack open as a possible new oil province (p. 61).

Don't look for any new California tidelands parcels to be put up for bidding in the near future.

No companies have asked the state to put other parcels up for bidding despite reports of successful core tests on two tracts.

Reasons advanced:

...Offshore operations are strictly big league in costs.

...More oil discoveries are not needed in California.

New data are available on air drilling (p. 99).

Recent survey of 226 wells drilled with air shows average cost per foot for air was $1.37, or 92 cents per foot exclusive of standby charges.

Where no water was encountered in the hole, the footage cost sank to 77 cents per foot or 51 cents plus standby.

Atlantic Refining's oil sniffer is being adapted for use on seaplanes.

The patented method detects hydrocarbon seeps in submerged areas. Plans are now to put it to work in the Fort Good Hope block in Canada's Northwest Territories.

Key to the method is an infrared analyzer unit which

checks for methane. It has undergone extensive tests in the Gulf area mounted on a small barge or boat. Seeps leaking as little as 0.5 cu. ft. per hour have been located.

▼ ▼ ▼

Canadian drillers are learning that greater markets for Alberta crude may hold the key to their future activity:

Alberta now produces only about 350,000 bbl. daily of its potential 850,000 bbl. daily.

Dr. G. W. Govier, member of Oil and Gas Conservation Board, recently told drilling men this could double to 750,000 bbl. daily by 1965.

He pointed out that current production rate of 40% matches the ratio of busy drilling rigs to those idle.

▼ ▼ ▼

Most likely reason for trip of Mac L. Coker to Venezuela: He'll help government there establish market proration.

The Texas Railroad Commission engineer will work for the next 6 months with Venezuelan technicians, probably for the new Venezuelan commission for conservation and marketing of hydrocarbons.

The Betancourt regime is disturbed by Venezuela's oil future. Betancourt fears Venezuela will deplete national wealth too quickly. World surplus and soft prices also are a worry (p. 63).

First performance data are now available on Atlantic Refining's closely-watched miscible drive in Slaughter field of West Texas.

It's first drive where operator is trying to improve areal sweep by following LPG and gas with water.

Company is asking Texas Railroad Commission to grant lease allowable for project plus allowable of 1,400 bbl. daily exempt from shut down to balance overinjection.

The added allowable is needed to prevent threatened oil migration across lease lines from the oil bank which is building up.

▼ ▼ ▼

Tariff has been cut on propane shipments from Texas to Ohio by the Little Big Inch. Cut was about 20%—from 82 cents to 66 cents per barrel.

Texas Eastern originally reduced rates by about 15% last January on all products except propane. Company said at that time cut was possible because federal transportation tax was lifted and operating costs and investment were below original estimates.

West Pakistan gas is still very much in the running as source for commercial shipments of liquefied methane.

A team from Constock International Methane is expected to make its second visit to Karachi soon. The Americans were cautiously optimistic about tapping Sui gas after their first trip. The Pakistan finance minister also has visited the U. S. to discuss the proposal.

One result of the talks: A carbon-black plant may be built in West Pakistan, one of few outside the U. S. Talks have already been started by Constock and Burmah Oil (p. 61).

▼ ▼ ▼

In Washington:

Fate of proposed gasoline-tax increase may be determined this week by House ways and means committee. The tax will be considered with proposals to help finance the limping federal highway program (p. 50).

National policy to encourage foreign trade and investment by Americans is urged before Senate committee by Jersey Standard Treasurer Emilio G. Collado. He terms the private U. S. investments abroad as one of this nation's most important weapons in cold war (p. 41).

▼ ▼ ▼

Texaco continues to beef up its operations in the Western Hemisphere with planned purchase of Paragon Oil. Firm is large fuel-oil marketer on East Coast.

Thus Texaco has a ready-made outlet for a big slug of resid which will result from its expanded producing-refining operations in the Caribbean region.

Analysts view Texaco move as further evidence of oil company efforts to tighten operations and improve efficiency by more complete integration. They cite Sinclair-British Petroleum, Continental-San Jacinto, Tidewater-Skelly, and many other deals (p. 44).

▼ ▼ ▼

Latest in gasoline marketing is the portable station.

A virtual boom in the skid-mounted units is taking place in Texas, probably will spread (p. 46).

They chuck out the window the supermarket approach to oil marketing. They simply sell gas and oil as cheaply as possible, ignore TBA, repairs, and services. Initial cost and operating costs are low, the profits good.

Pemex is asking the Mexican Government to extend its monopoly to petrochemicals.

Request for exclusive rights covers items to be made in new plants for which the state company recently made financial arrangements abroad.

Under the Pemex plan, imports would continue until products of the new plants came onto the market. Products involved include butadiene, toluol, methenol, ethylene, anhydrous ammonia.

Bovaird Oil Well Supplies 1871

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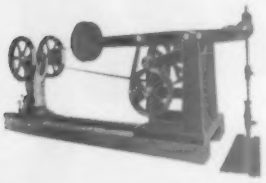
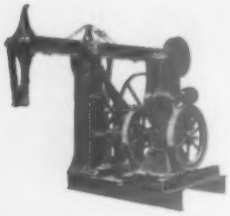
88 YEARS OF PROGRESS WITH THE OIL INDUSTRY

"Oilwell" Pumping Units down through the years



1902 This early beam-type pumping unit had cast-iron frame and single-reduction, open-spur gear train.



1916 Featured unitized structural steel walking beam and base beam. Note double-reduction, open-spur gearing.

1928 This foreshadowed modern units with its counterbalanced cranks and enclosed single-helical gearing mounted in tapered roller bearings.

1935 By this time, slab-type counterweights were introduced. Symmetrical gear cases permitted end-for-end reversal of shafts for utilizing both sides of gear teeth.

1955 Fully adjustable counterbalanced cranks were employed with counterweights moved easily along calibrated crank rails.

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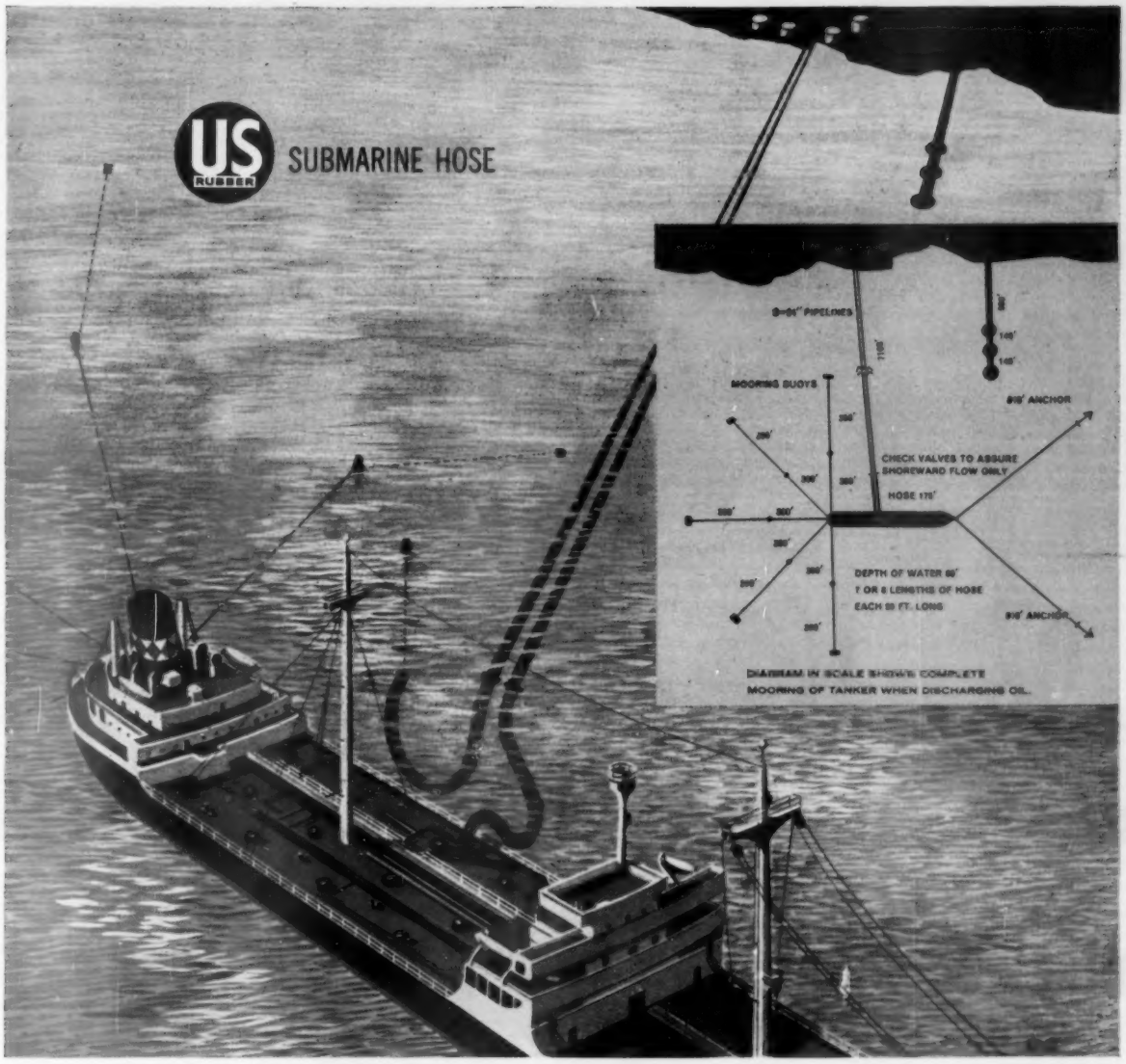
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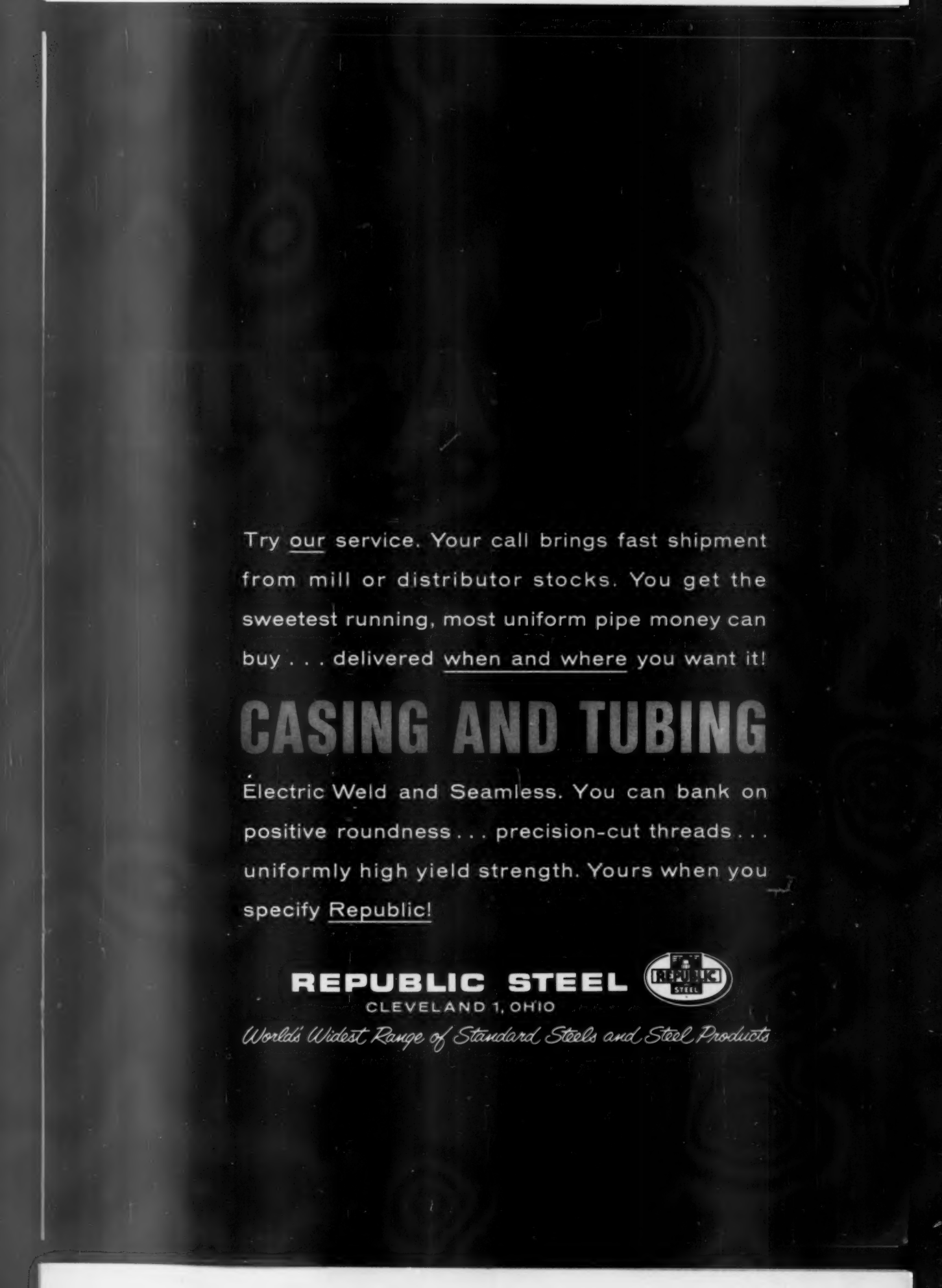
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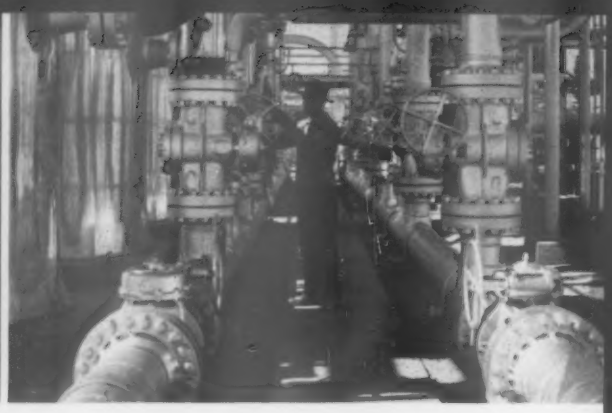

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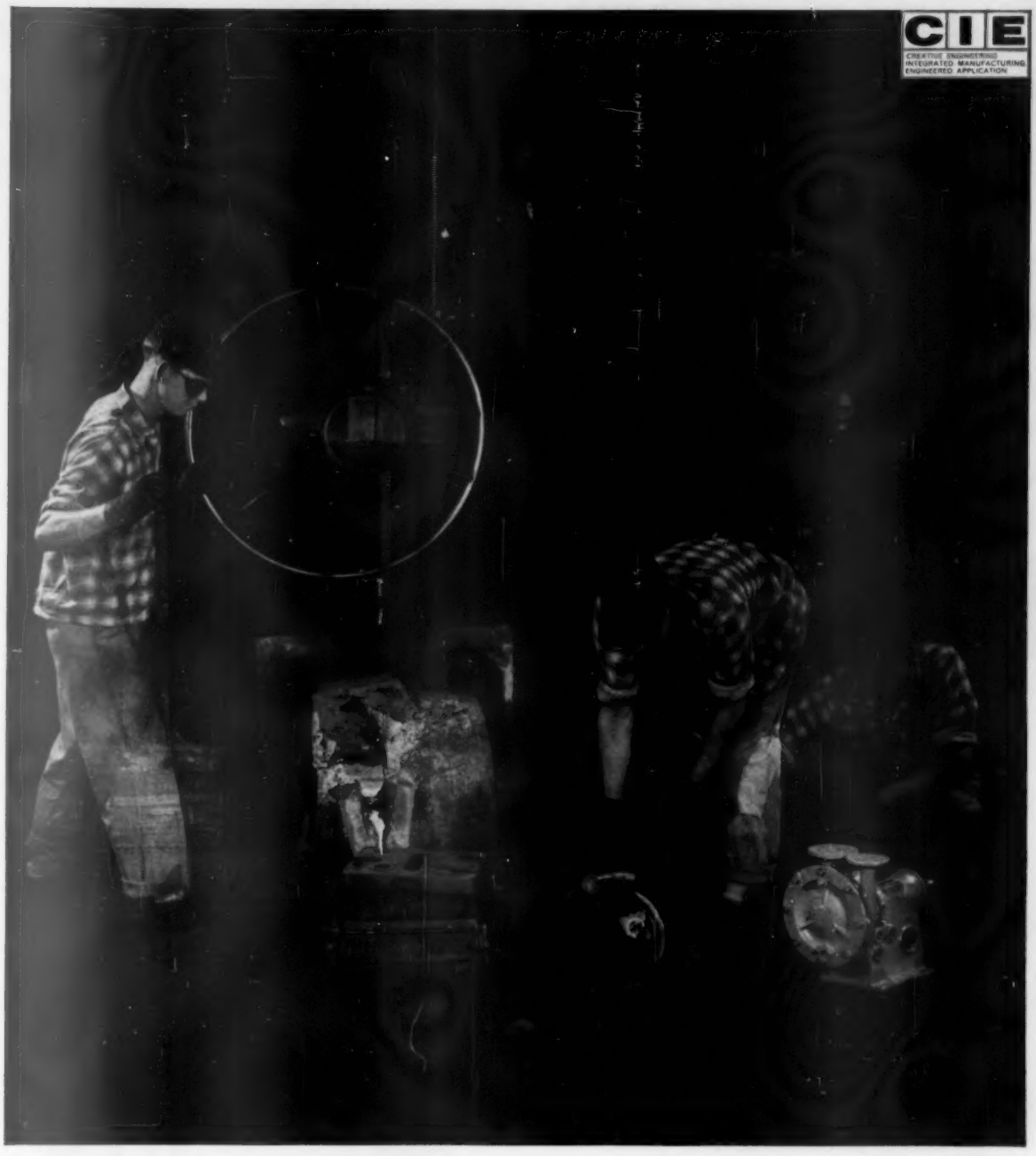

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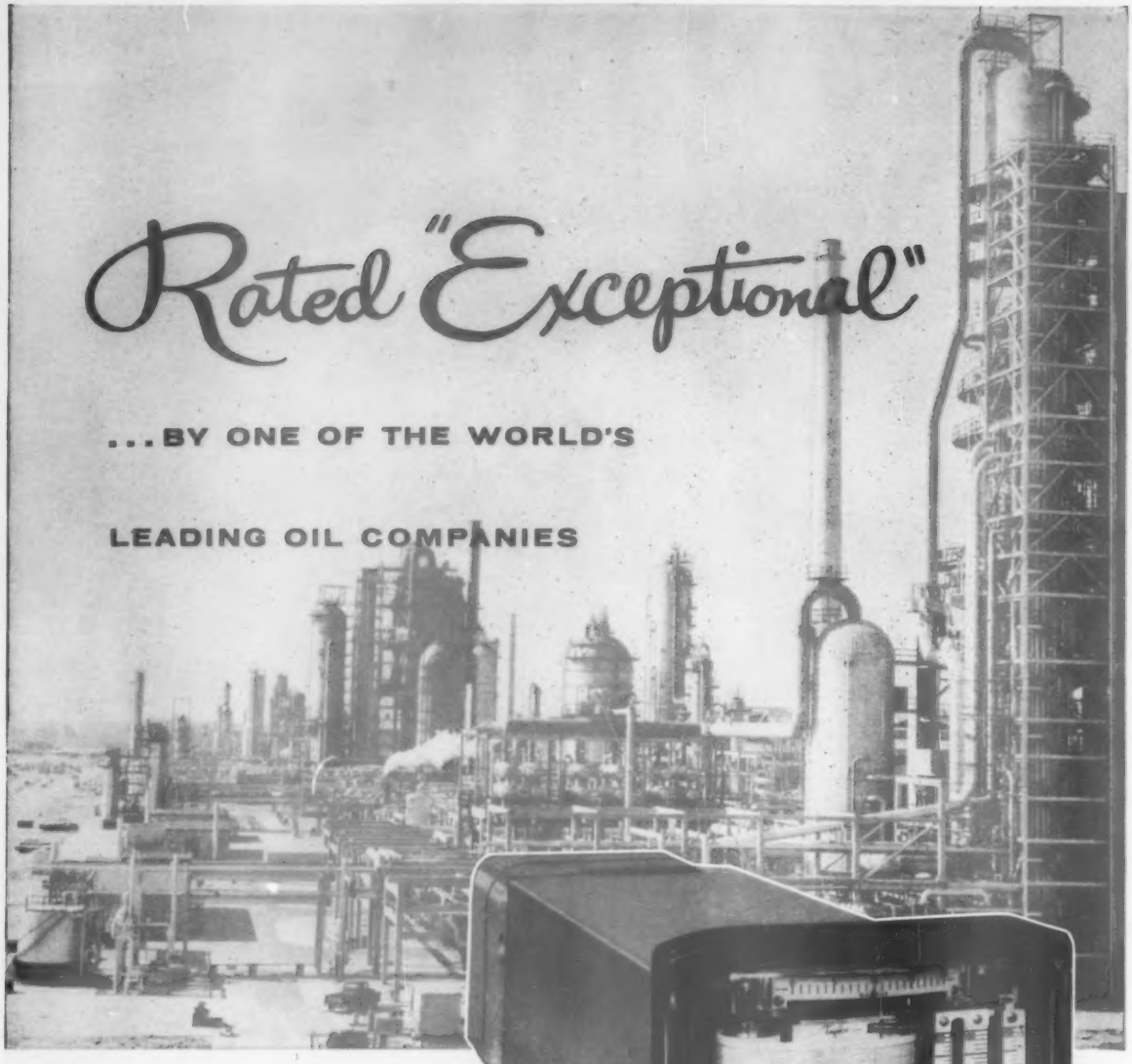

An internationally famous oil company recently carried out exhaustive tests on the Taylor 90J TRANSCOPE* Recorder. This particular company is continually testing and evaluating instruments from all over the world.

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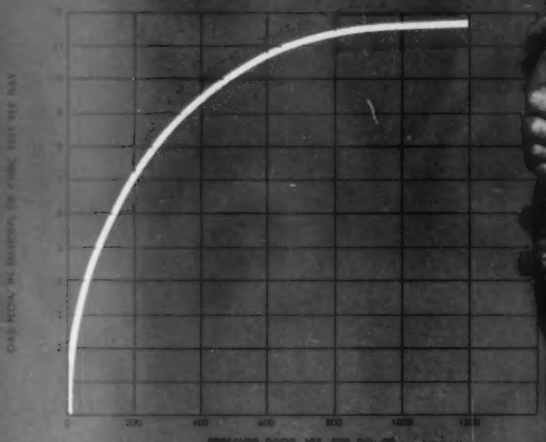


FLOW OF GAS THROUGH UNIBOLT CHOKE
WITH ½" SEAT AT 2000 PSI INLET PRESSURE

if you could produce 10,000 bbls. per well per day . . .

. . . as the charts show, this UNIBOLT Adjustable Wing Valve would handle the fluid with only a 100-lb. pressure drop! Or, you could produce 28 million cubic feet of gas through it with only a 200-lb. pressure drop. So, while the UNIBOLT Adjustable Wing Valve is not a full-opening type, its one-inch flow area is far more than adequate for practically any desired production rate—*and the cost is importantly lower than for conventional gate and plug valves.*

Actually, there's a dozen more good reasons why this UNIBOLT Adjustable Wing Valve is a solid favorite among value-conscious operators:

1. There are no exposed threads . . . no accidental damage.
2. All metal seats . . . not affected by high or low temperature.
3. Stem packing that needs no tightening.
4. Stem turns freely under high pressures.
5. Threads on stem not exposed to external or internal damage.
6. Full 2½" pilot for true stem alignment and rigidity.
7. Streamlined flow—no obstruction, no turbulence or impingement of flow, no negative pressure areas.
8. Requires no grease to effect a seal . . . may also be used as micrometer-gauged flow bean.
9. Variable choke speeds up initial clean-up or running initial flow tests . . . saves rig time.
10. Can be converted to "Pressurematic Safety Valve" by simply changing bonnet assemblies.
11. Valve can be completely overhauled without removal from tree.
12. Stem seat sealed by metal gasket; power threads assure alignment.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

THE PIPE TO BUY IS

ATLAS PIPE INC.

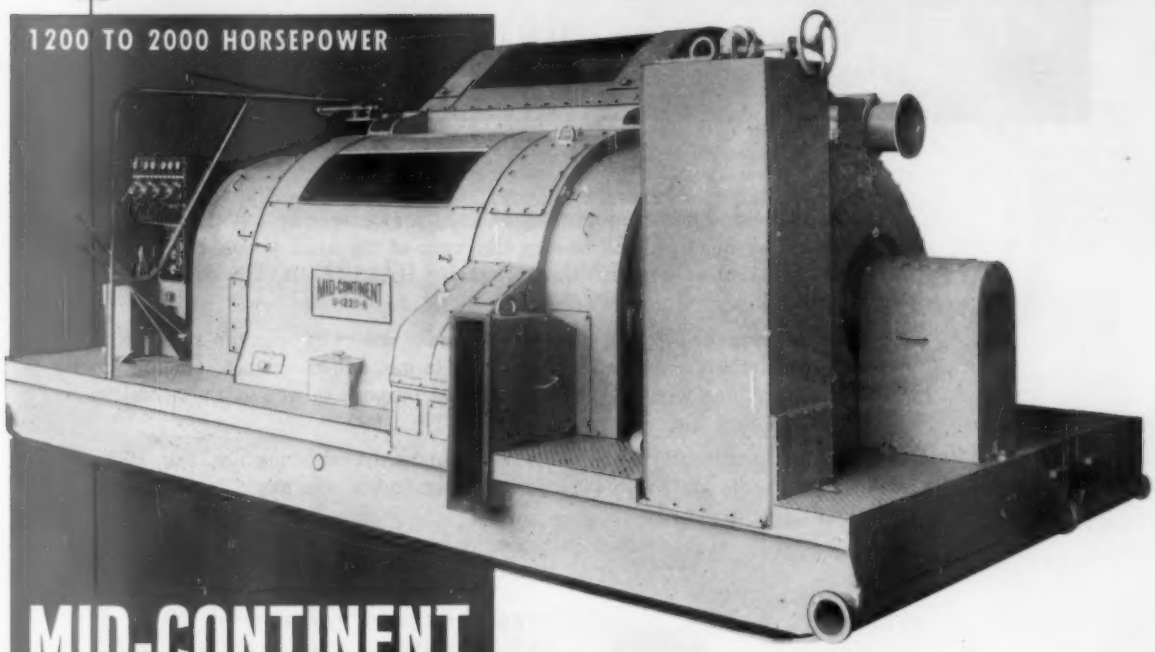
511 First City National Bank Bldg., Phone: CApitol 3-4314, Houston 2, Texas
Houston Plant: 7707 Wallisville Road, Phone: ORchard 2-1704 • Corpus Christi Plant: P. O. Box 2368, Hwy. 44, Phone: TUlip 4-6371 • Tulsa: 2104 South Detroit, Phone: Diamond 3-6791.

ATLAS PIPE INC. IS AN ORGANIZATION OF
250 PEOPLE DEVOTED TO SELLING AND SERVICING
TUBULAR GOODS FOR THE PETROLEUM INDUSTRY

New efficiency...

FOR TODAY'S DEEPEST DRILLING

1200 TO 2000 HORSEPOWER



MID-CONTINENT
U-1220-B
DRAWWORKS

The new U-1220-B Drawworks, rated at 1200 to 2000 net input horsepower, incorporates all the proven features necessary in a deep well rig, plus many new and improved features for maximum flexibility and more economical operation. For complete information, write for our U-1220-B Bulletin or contact your local Mid-Continent Representative.

- SIX FORWARD SPEEDS to the hoisting drum — two reverse speeds.
- THREE FORWARD SPEEDS to the rotary, catshaft, and optional sandreel — one reverse speed.
- EXTRA LARGE BALANCED DRUM — 32¼" diameter by 57" long barrel.
- FAWICK VENTORQUE 42VC1200 hi- and lo-drum clutches.
- DOUBLE ADJUSTMENT MAIN BRAKES are fully equalized with 60" by 10¾" water circulating rims of roll forged alloy steel.
- UNITIZED CONTROLS conveniently located in a single console for greater operational efficiency.
- GREASE LUBRICATED BEARINGS with flood lubrication provided for chains, sprockets, and splined clutches.
- TWO-SECTION CONSTRUCTION to simplify rig-up and moving.

DWS-9

MID-CONTINENT SUPPLY CO.

MID-CONTINENT BUILDING • FORT WORTH, TEXAS

Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

HALLIBURTON'S *"well-designed"* CEMENTING TOOLS

For an unmatched combination of superior cementing tools and skilled cementing personnel... both bearing the name of the world's most experienced oil well cementing organization... specify HALLIBURTON for a better cementing job.

Because even the best tool is no better than the skill of its operator, Halliburton tools are effectively controlled by thoroughly trained and experienced Halliburton Cementers... men who know the design and purpose as well as the operation of the tools they use.

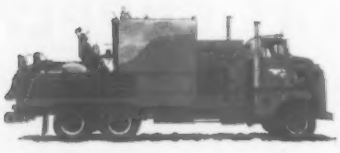
Put this profitable "work team" on your next cementing job. For "well-designed" tools and "well-experienced" cementers, the name to remember is Halliburton.

TYPE "J" TEXAS PATTERN CASING SHOE

... with open end, used in rotary drilled wells of shallow areas and shallow cable drilled wells where it is not necessary to guide or float the casing to bottom. Reinforces lower end of casing column to reduce damage to casing, aids in running-in past hole obstructions.

TYPE "L" LINER SET SHOE

... essential aid for correctly setting and cementing liner on bottom. Available with or without fluid ports. The saw-type teeth help to keep the liner from rotating while setting tool is backed off; ports allow free circulation of cement or fluid to the outside with liner resting on bottom.



HALLIBURTON
OIL WELL CEMENTING COMPANY
Duncan, Oklahoma

THESE HALLIBURTON TOOLS...AND MANY OTHERS AID IN BETTER CEMENTING OF YOUR WELL

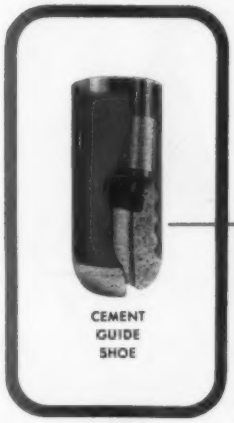
HALLIBURTON SUPER SEAL FLOATING EQUIPMENT

Meets all requirements for floating and cementing of casing—landing on bottom and circulating great volumes of fluid, holding slurry outside casing even in the deepest wells.

"Super Seal" Float Valve Assembly in Halliburton Float Collars and Float Shoes are recommended for any weight casing, through N-80 grade, to pressure equal to the collapsible pressure of such casing, provided weight ranges of both are matched. Composed of phenolic impact compound for greater compressive strength than normally required—is inert to most acids and solvents—is unaffected by known well fluids or temperatures up to 400°F. Held securely in steel coupling by high compressive and shear strength concrete—presents no "drilling-out" difficulty.

Fluid-flow areas allow maximum pumpability through valves and concrete guide nose even where high mixtures of cement or mud additives are required.

Rubber Seal Ring is oil-resistant and with Super Seal Valve Assembly seals-off "Fluid-tight," even after many continuous hours of high speed pumping of mud and cement with abrasive materials and additives. Also acts as a shock absorber for side-wise vibrations, protecting Back Pressure Valve from wear while pumping. Plug Seat Insert of impact plastic molded in concrete of Float Collars and Float Shoes in all standard sizes, provides a plug seat even greater than with concrete alone.



HALLIBURTON CEMENT GUIDE SHOE

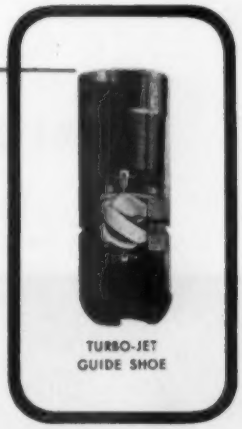
The landing of the first joints of casing on bottom to be cemented may be hazardous. Safety is increased by installing a Cement Guide Shoe on the first joint. The strong, durable, rounded Guide directs the casing away from ledges to reduce side-wall caving, safely passes through crooked holes, and penetrates temporary bridges.

HOWCO WELD

A thread compound proven superior to tack-welding for locking threaded connections tightly and permanently. Designed to provide necessary bond to prevent thread connections from backing out without welding. HOWCO WELD is convenient to use, economical and easily applied.

HALLIBURTON TURBO-JET GUIDE SHOE

Guides strings of casing to bottom and has a built-in "rotor" which provides a forceful "jetting" action of fluid at shoe joint for better cement distribution around casing shoe and behind pipe to minimize channeling. "Jets-off" and washes mud-cake from hole bottom while rotating or reciprocating pipe—penetrates bridges while running casing—circulates fluid out through side ports when casing rests on bottom. All parts are drillable.



CEMENTING SERVICES

"A Well Worth Cementing Is Worth Cementing Well"

". . . supply stores have not faltered in giving good service"

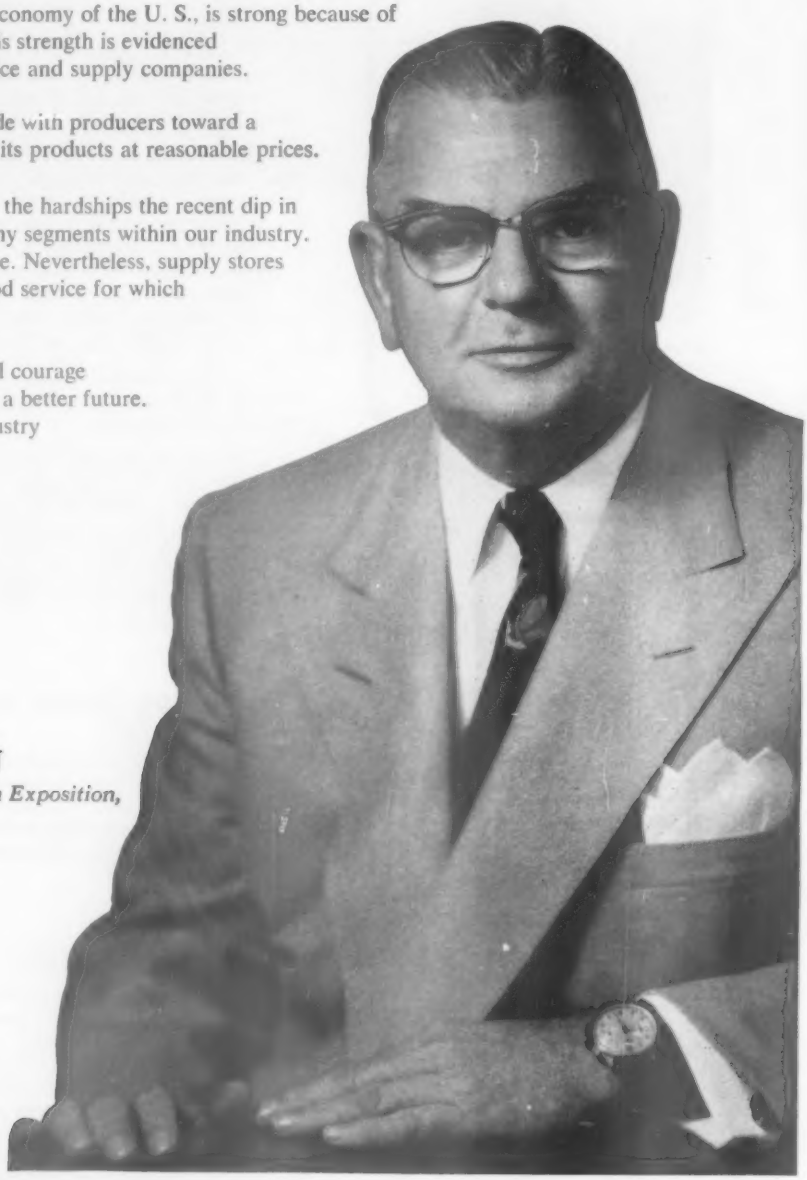
"There are Prophets of Gloom who continuously cry that 'We are running out of oil.' I am not one of them because I am firmly convinced that America will not run out of oil in the foreseeable future—provided our system of private enterprise is allowed to take its natural course.

"The oil industry, like the overall economy of the U. S., is strong because of such a system. One example of this strength is evidenced by the industry's equipment, service and supply companies.

"Those companies strive side by side with producers toward a common goal: Adequate oil and its products at reasonable prices.

"All of us in the industry recognize the hardships the recent dip in the oil activity has worked on many segments within our industry. The supply industry is one of these. Nevertheless, supply stores have not faltered in giving the good service for which they long have been noted.

"This is the type of doggedness and courage that licks problems and builds for a better future. And, certainly, the petroleum industry has a great future."



MR. W. K. WARREN
President, International Petroleum Exposition,
Chairman of the Board and
Chief Executive Officer,
Warren Petroleum Corporation

P.E.S.A.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

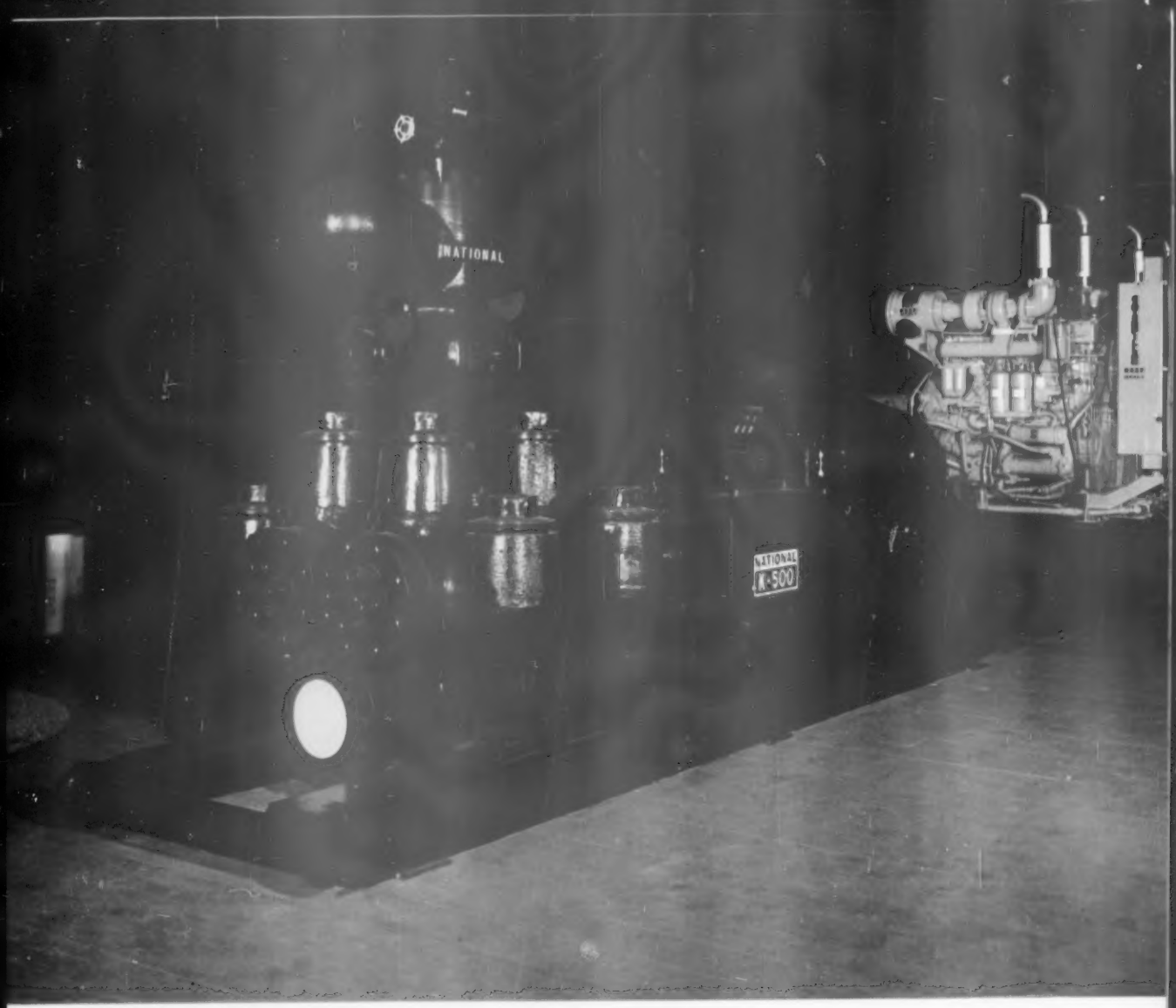
PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

These Raybestos Manhattan products are typical of the broad line of quality items stocked and distributed through National's 124 stores.

This is the NATIONAL SUPPLY STORE, too!

The next time you stop in a National Supply Store, remember to shop *behind* the counter, too. You'll see quality products like these Raybestos Manhattan products, Westinghouse Motors, Larkin products, Link-Belt Chain, Ajax Engines, Oilmaster Pumps, Tube-Turn fittings, Rockwell-Nordstrom Valves, Columbian Rope and many more. Wherever you go, National Supply offers you an unmatched variety of quality products.

On the next pages:
New NATIONAL Slush Pumps!



The new K-500 Pump is rated at 500 input horsepower with 7½-inch minimum bore and 15-inch stroke. Its rated speed is 70 strokes per minute.

New NATIONAL Type K Pumps set the

They're rugged, lightweight and easy to maintain!

Would you like 19 easy accessibility features that make a pump easier to maintain? They're here. The features you want . . . the features that help to make money for you . . . are in these new slush pumps from National. Both the K-500 and K-700 are carefully designed for all modern drilling needs in their horsepower ranges,* and will give you better service than any comparable pumps you can buy. Big statement?—yes, but look at the advantages that make it possible:

- These K pumps incorporate new design fluid ends that provide easier maintenance—fast change cover plates and cylinder heads.
- Light weight with high structural rigidity—reduces transportation costs.
- Longer life for connecting rod and main bearings—harmful reversal load impacts effectively controlled.
- Easy crosshead maintenance—tapered crosshead pin simplifies removal and reassembly of crosshead.

*For horsepower needs beyond 700, ask a National representative about the successful H-850 and H-1250 pumps which these K models complement.

The new K-700 is rated at 700 input horsepower with 8-inch minimum bore and 16-inch stroke. Its rated speed is 65 strokes per minute.

pace in streamlined pump design!

■ Reduced wear for stuffing boxes, piston rods, pistons and liners—striking-locking collar on intermediate rod forms positive alignment link between crosshead and piston rod.

■ Efficient lubrication—greased packed roller bearings—pinion, main connecting rod bearings positively sealed against contamination.

■ Accurate piston rod alignment reduces wear—longitudinal bores of power end frame and fluid end positively aligned by accurately machined stuffing boxes.

■ National Pulsation Dampener—eliminates troublesome rubber diaphragms, bags and sleeves—only rubber element is inexpensive valve disc easily and quickly replaceable.

Get the complete story on both of these pumps . . . ask the National man in your area for new bulletins which graphically detail construction and performance features. You'll find that National's Type K pumps are unequalled!

More on the next page . . .

...and NATIONAL Fluid End Parts reduce your maintenance costs!

DUAL SEAL PISTON

Incorporates two replaceable piston rubbers, forming an inner and outer seal at each end of the piston. Void between the rubbers allows space for displacement, minimizes damage to piston lips as it enters liner. Heavy fabric section molded into the back of inner rubber dams off extrusion around the OD of hub, and reduces pinching of the rubber. Forged steel hub of piston resists expansion under extreme loading.

FLUID PISTON ROD PACKING

Fluid pressure actuates the sealing lips. The greater the pressure, the tighter the seal . . . yet the solid make-up through the body of the packing minimizes the danger of overtightening it when it is installed. Rod wear is sharply reduced, because lip pressure is never excessive . . . in fact, it is negligible on the suction stroke.

FLUID CYLINDER LINERS

The ID of the Nationaloy Liner is case hardened throughout its length. Precision honing gives it maximum resistance to wear, washing and abrasion. Outside surface is machined to close tolerances, promoting closely controlled fits which reduce piston and rod wear due to misalignment.

FLUID CYLINDER LINER PACKING

Resistant to oil, gas heat and chemicals, National Liner Sleeves provide a perfect seal between the liner and pump bore. They are sufficiently hard to be confined in the packing space . . . preventing excessive flowing and pinching . . . yet they retain ample resiliency for proper sealing action.

"BLUE STRIPE" AND "BLUE CHROME" PISTON RODS WITH API TAPERS

Have maximum tensile strength and high resistance to impact. Precision ground and polished to reduce wear of both packing and rod. "Blue Chrome" Piston Rods have a super-hard, abrasion-resistant chrome finish which gives added packing and rod life under all conditions.

TYPE G-2 FLUID VALVES AND SEATS

Promote maximum pump efficiency, with maximum effective opening for fluid flow to permit complete filling at high speed. The lower guide . . . integral with the valve . . . has a large contact area which reduces wear and minimizes the possibility of cocking. A heavy clamp plate and lock gives longer valve life.

LOOK FOR THE BLUE AND YELLOW LABELS AT ALL NATIONAL SUPPLY STORES!

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1

Litho in U. S. A

New Nalco Coagulant makes Larger, Heavier Floc . . . Faster

Radically different Nalcolyte 110 used with Conventional Chemicals to Cut Costs, Speed Action in Water Clarification

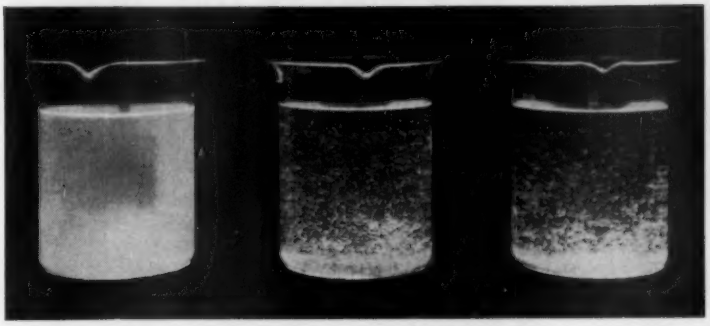


Photo taken in Nalco Laboratories 7 seconds after agitation stopped: *Left*, Control sample of untreated turbid water; *center*, same water, treated with 50 ppm alum; *right*, same water, treated with 20 ppm alum, 1 ppm Nalcolyte 110. Note that large, dense floc is settling out much more rapidly than center alum-treated sample.

Nalcolyte 110 is a non-ionic organic polyelectrolyte flocculant of very high molecular weight—over 1,000,000. It is used in extremely small dosages with conventional coagulants (such as sodium aluminate, alum, ferric sulfate) to increase size, density and uniformity of floc.

Less Chemical; Greater Capacity

Action of Nalcolyte 110 in creating heavier, larger, faster-settling floc not only permits greater throughput rates without floc carryover to processing equipment, but also cuts the total chemical requirements at a resultant cost saving.

In the example illustrated above, only 40% as much alum is required when Nalcolyte 110 is used.

May be Used in Potable Waters

Approved by the U. S. Public Health Service Technical Advisory Committee for use in treatment of public water supplies, Nalcolyte 110 gives water works the opportunity to get appreciably greater capacity from existing clarification equipment—at lower treating cost.

High Suspended Solids No Problem

Waters containing high suspended solids respond quickly to Nalcolyte 110 coagulating action . . . frequently without other coagulant chemicals.

Typical high suspended solids waters which can be treated with speed and economy with Nalcolyte 110 are paper mill white water systems, industrial waste waters, mineral slurries and blast furnace gas wash water slurries.

Nalcolyte 110 Easy to Handle

Nalcolyte 110 is a coarse, white, free-flowing powder of non-toxic character. It is fed in dilute water solutions with standard liquid proportioning pumps or feeders. Stock solutions are prepared at concentrations up to 20%. Packaging is in convenient 25-lb. bags.

Data Available Promptly

Full information on Nalcolyte 110 for your coagulant use is ready to be sent upon your request. Write today, or call your Nalco Representative.

National Aluminate Corporation is now

NALCO CHEMICAL COMPANY

6242 West 66th Place • Chicago 38, Illinois

Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany

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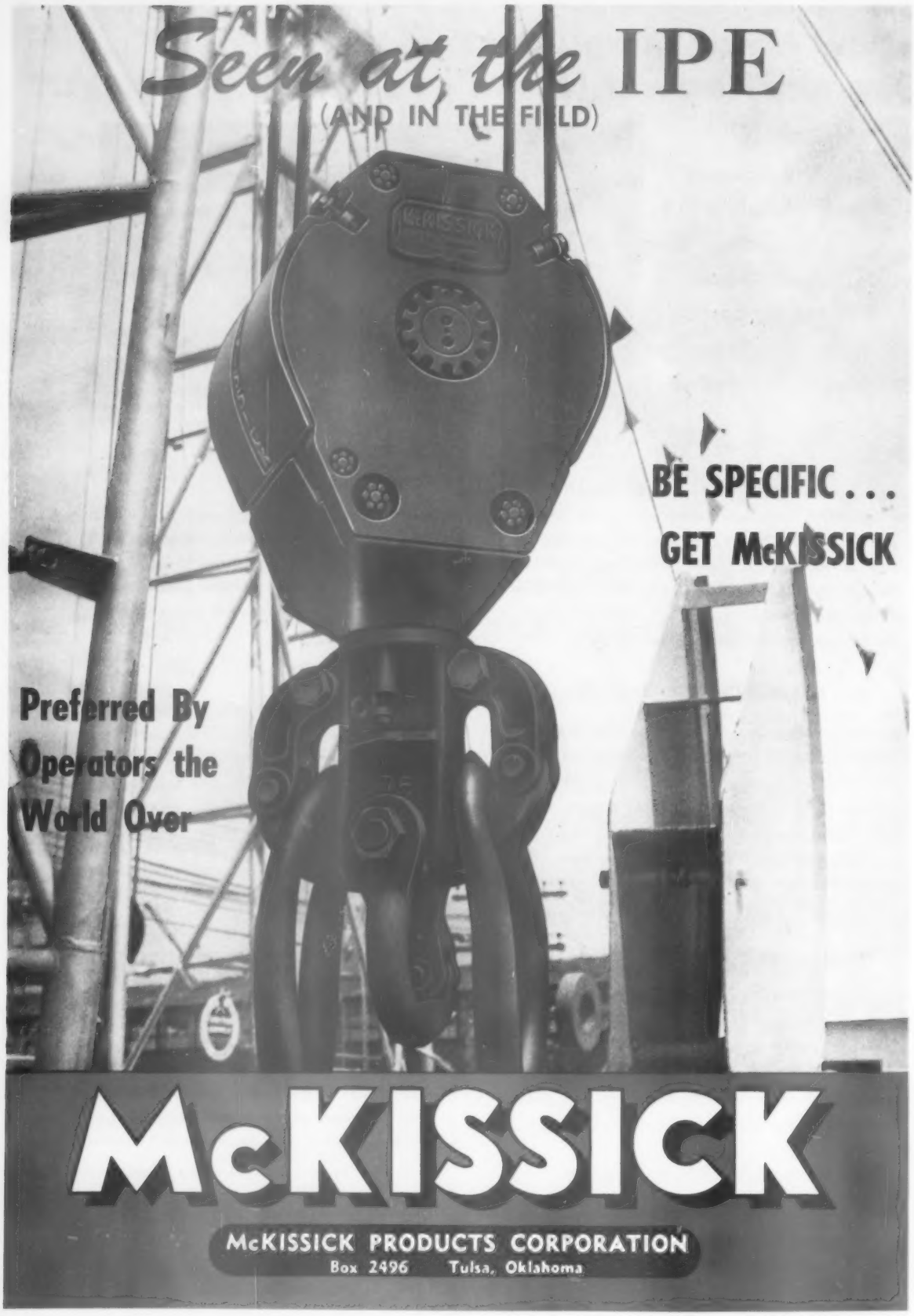
. . . Serving Industry through Practical Applied Science

Nalco CHEMICALS


Seen at the IPE
(AND IN THE FIELD)
BE SPECIFIC . . .
GET McKISSICK
Preferred By
Operators the
World Over
McKISSICK
McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

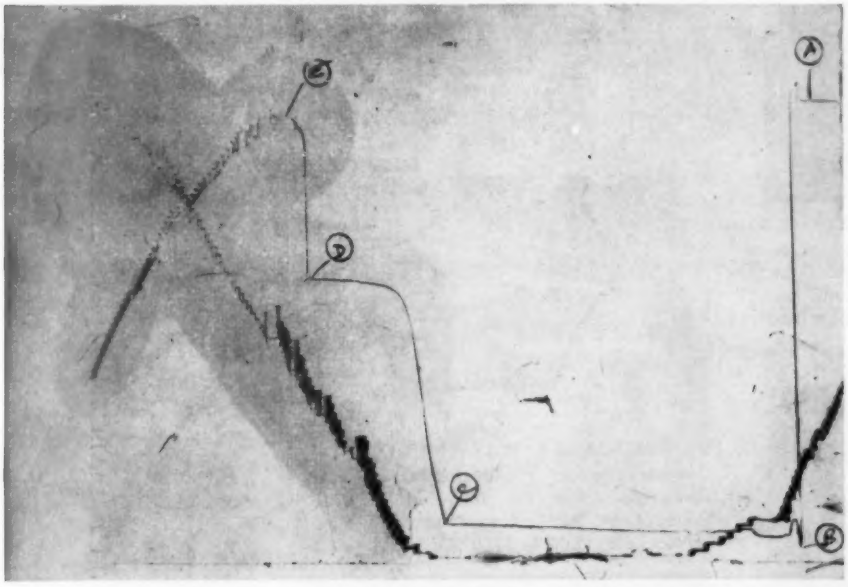
168 Barrels Of Oil A Day From A Dry Hole

This is the story of how an apparent dry hole was made a 168 bopd producer. The well was drilled by Mr. A. C. Torgeson of Torgeson Oils, Inc. who realized a successful producer from a wildcat well that could easily have been abandoned. The well was spudded in Weld County, Colorado, and was projected for the "J" sand around 6900 ft. The sand, when reached, was cored and an electric log was run. These revealed conclusively that the "J" sand was unproductive . . . that it contained only water. Had it not been for the alertness of the consulting geologist on the well, Paul "Skipper" Keller, the well would have been plugged and abandoned. Keller, however, had noticed an oil show in the cuttings from the "D" sand approximately 100 feet up the hole. The "D" sand was generally unproductive in the area and a thorough study of all available evidence indicated that it probably would be unproductive in this well even though there was a show in the cuttings. Normally a well of this type would have been abandoned immediately, but Mr. Keller was reluctant to do this in spite of the seemingly overwhelming odds against making a successful producer. The decision was then made to run a drill stem test on the "D" sand in order to evaluate all the available information. The result was a producer!!!

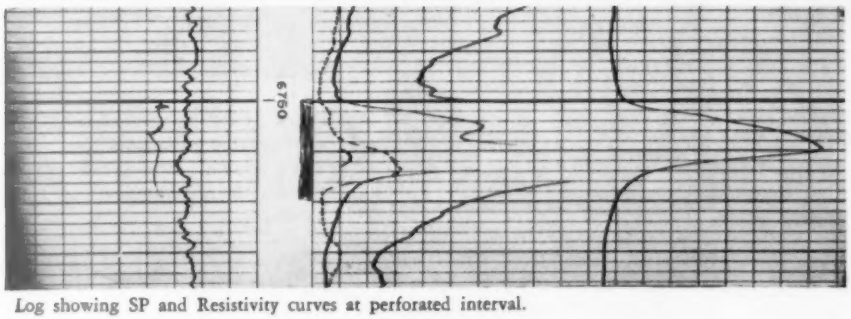
To obtain the test information which resulted in a positive decision to complete the well, Johnston Testers was called in from the Fort Morgan office and a straddle test was run. On the basis of the drill stem test, casing was set and the well perforated from 6758 to 6764 ft. The initial flow of the well was 168 bopd through a 30/64" choke. No well stimulation treatment was required and a dry hole became a producer.

This is an excellent example of the necessity of gathering and evaluating all the data possible before setting casing on a well that might be dry, or before abandoning a possible producer.

This well clearly demonstrates that it is unwise to discount any possible pay or write-off any well prematurely. It also demonstrates that Drill Stem Testing pays off in handsome dividends. The cost of a drill stem test is very small compared to the investment made in the drilling of the well. Test—to be absolutely sure.



Drill Stem Test chart for the Torgeson State No. 1. Tool was open for two hours with forty-five min. shut-in. Gas to surface in 18 min. (800,000 cu. ft.) and a good blow was observed. 550 ft. of oil and 270 ft. of oil and gas cut mud were recovered. No water was present. Initial flow (B) was 108 psi and final flow (C) was 291 psi. Final shut-in pressure (D) was 2221 psi.

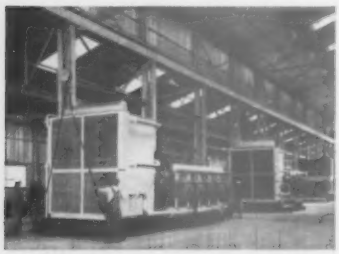


Log showing SP and Resistivity curves at perforated interval.

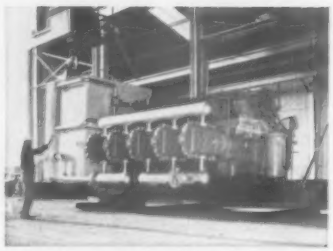
JOHNSTON DRILL STEM TESTING TESTERS

A single objective

CB/S CONTROLS are custom designed for *your* installation. Cooper-Bessemer En-Tronic remote control above can take over entire operation.



CB/S COOLERS are custom designed to match engine-compressors to specific field conditions.



DYNAMICALLY BALANCED Cooper-Bessemer engine-compressors reduce vibration to a minimum. Low RPM for maximum service life; 265 to 1100 BHP.

SPECIAL WELDING. CB/S uses back-up rings in *every* welded connection, not just at critical points. Welds are clean inside as well as out.

CB/S SCRUBBER is custom-built for greater freedom from shutdown due to liquid surges. Scrubber auxiliary equipment is finest available.

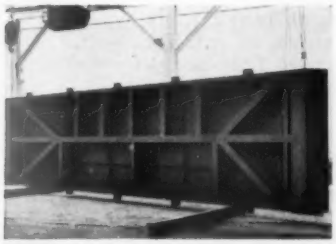
makes the difference . . .

CB/S
PACKAGED
COMPRESSORS

CB/S brings a new concept of specialization to the manufacture of packaged gas compressors. At CB/S all research, design and manufacturing have the *sole* objective of creating packaged units that will set new standards of dependable, economical, performance throughout the world. This dedication of purpose is found in every detail — from specially welded connections to the extra-rugged skid.

And, as a subsidiary of The Cooper-Bessemer Corporation, CB/S is uniquely able to coordinate design requirements of Cooper-Bessemer engine-compressors with your specific field requirements. This results in *optimum performance* and *undivided responsibility* for the entire package.

Before ordering your next packaged compressor, look into the specialized design and single responsibility of CB/S. Building better packaged compressors is our *only* business.



STRONG A-FRAME SKID is custom-designed for the engine-compressor; completely covered with checkered floor plate; no piping in skid.

TELETYPE CONNECTED warehouses in all major producing areas insure fast service and parts.

CB/S SOUTHERN INC., P. O. BOX 19267, HOUSTON 24, TEXAS

Shop your nearby SUPPLY STORE

It's well stocked with quality AMERICAN IRON Oil Field Equipment

You'll also find a complete stock of other drilling and producing equipment. Your Supply Store has this equipment ready for you, when and where you need it. They are at your service 24 hours a day, seven days a week.

Get the economical habit of shopping and buying at your Supply Store. And while you're there, check the large stock of quality AMERICAN IRON drilling and producing equipment. This is the equipment you can be sure will help you operate profitably.

SPECIFY AMERICAN IRON

Another AMF Product PETROLEUM EQUIPMENT

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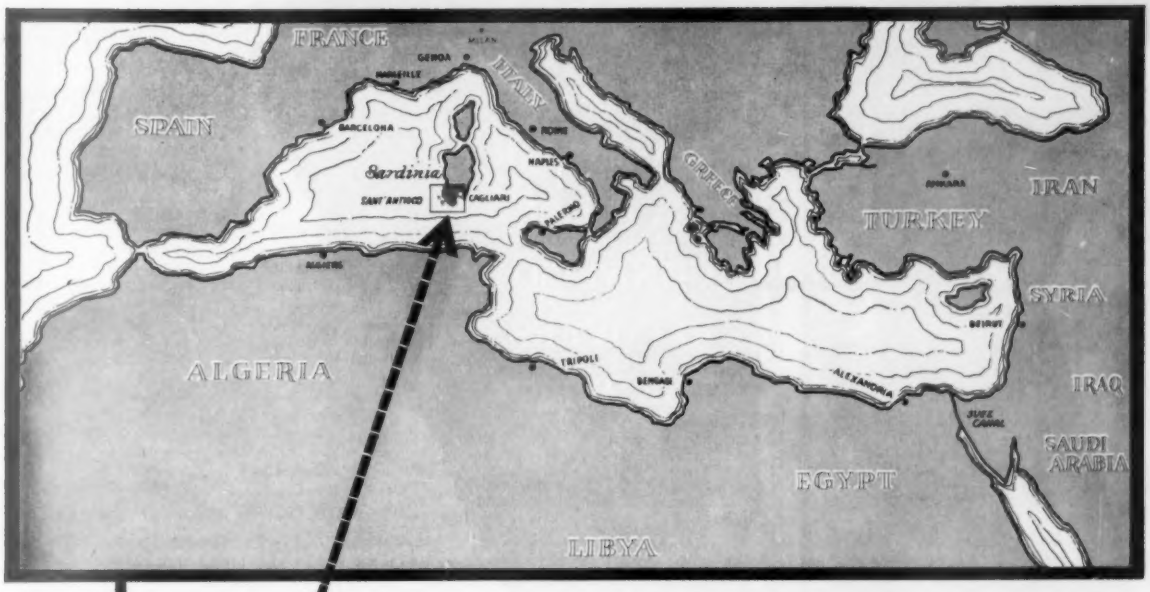
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

36 Years' Experience in Designing and Manufacturing Oil Field Equipment.

AMERICAN IRON & MACHINE WORKS CO., INC. • OKLAHOMA CITY •



NOW: BAROID products direct from Italy

Baroid-Maffei S.p.A. now supplies the product BAROID* and other mud materials to oil operators in the Mediterranean and Middle East Areas direct from Italy. Baroid-Maffei mines, mills and ships BAROID from Sardinia to these areas. All products are processed under the world-wide quality control standards of Baroid Division.

Write or call Baroid Division, Houston, Texas or Baroid-Maffei, Milan, Italy for full details on products, port agent and maritime references.

*Registered Trademark of Baroid Division National Lead Co.

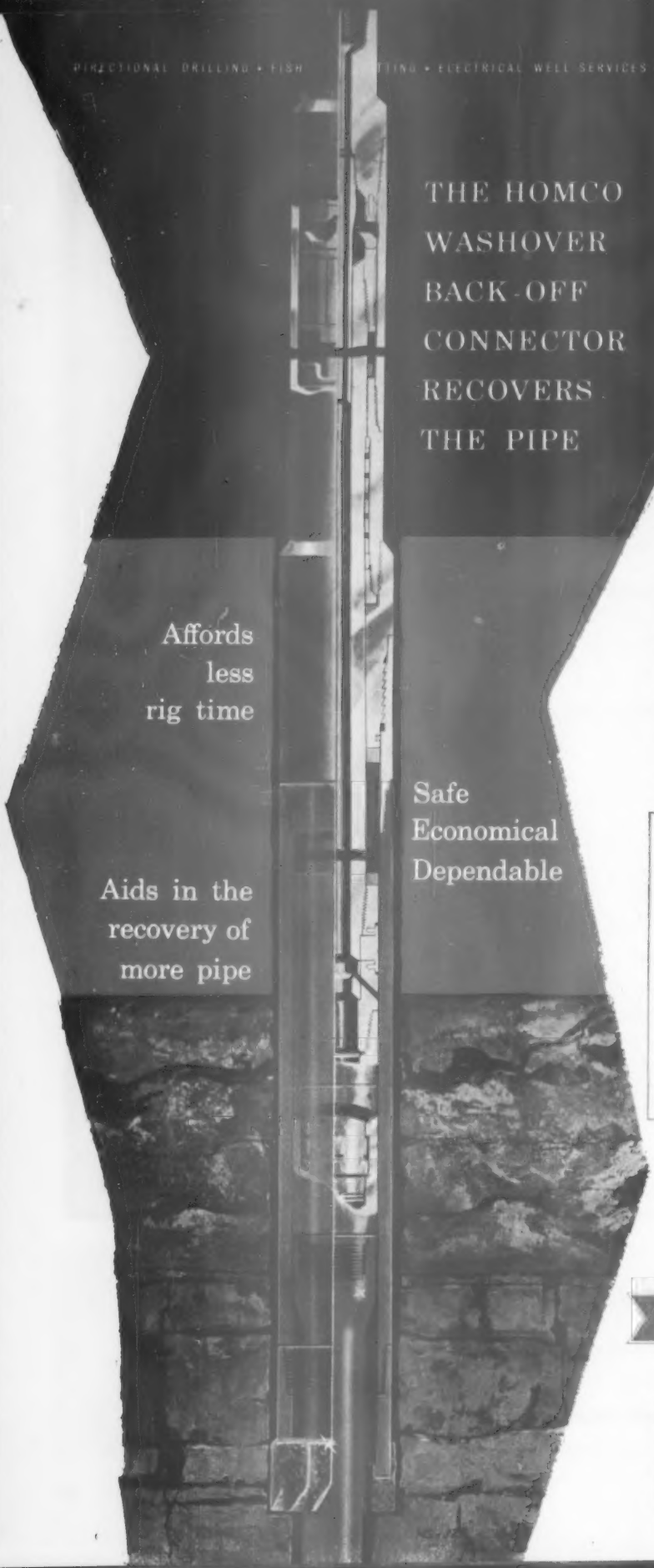
BAROID - MAFFEI S.p.A.

32 Piazza Repubblica Milan, Italy

Cable Address: Baroid Milano

5920*

DIRECTIONAL DRILLING • FISHING • ELECTRICAL WELL SERVICES • OILFIELD SUPPLIES • EXPORT TOOLS & SERVICE



THE HOMCO WASHOVER BACK-OFF CONNECTOR RECOVERS THE PIPE

HOMCO
Fishing, Cutting and Electrical Well Service

Affords less rig time

Aids in the recovery of more pipe

Safe
Economical
Dependable

The HOMCO Washover Back-Off Connector is designed to safely increase the rate of recovery of stuck drill pipe or tubing in washover operations.

The basic function of the connector is to enable the operator to washover and back-off with the string shot, recovering the "fish" with one round trip of the drilling string, thus saving rig time.

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They Say—

It's wrapped by Kermac

Dear Sir:

First of all, let me compliment Messrs. Reed and Kinney on their very fine story on "The Florida Pipeline—A New Concept in Gas Transmission"—which appeared on pages 108-116 of your March 9, 1959, issue.

In reviewing this article, however, I note one inaccuracy of substance which I believe you may wish to correct.

On page 112, you stated "A 15-lb. asbestos felt outer wrap protects the tape from damage during installation." As a matter of fact, 100% of the outer wrapping applied over the polyethylene tape on the Houston Texas Gas & Oil Corp.'s portion of this project, to date, has been Kermac Pipe Line Outer Wrap.

Mr. E. G. Kessler and I visited all of the construction spreads in operation during the first 3 weeks in January and found excellent reception for our outer wrap . . .

Again, we want to congratulate you on a nice report and believe that you will wish to correct this one inaccuracy regarding the over wrapping for the polyethylene so that The Oil and Gas Journal can maintain its reputation as the leading authoritative source of factual information for the oil and gas industry.

Frank B. Burns, Supervisor
New Products Development
General Asphalts, Inc.,
(subsidiary of Kerr-McGee Oil Industries, Inc.)

Smog not just LA's problem

Dear Sir:

We agree with your statement regarding the causes of smog in urban areas (OGJ, Newsletter, June 8). On the other hand, we feel that your capsule description of the problem was too sweeping a generalization.

Automobiles and/or refineries are not necessarily the only sources of organic emissions in any relatively large, densely populated area.

For instance, losses of various solvent vapors from dry-cleaning operations, from the use of paint and similar surface coatings, from certain types of printing operations, etc., also can result in daily emissions of hundreds of tons of organic materials capable of entering into the photo-

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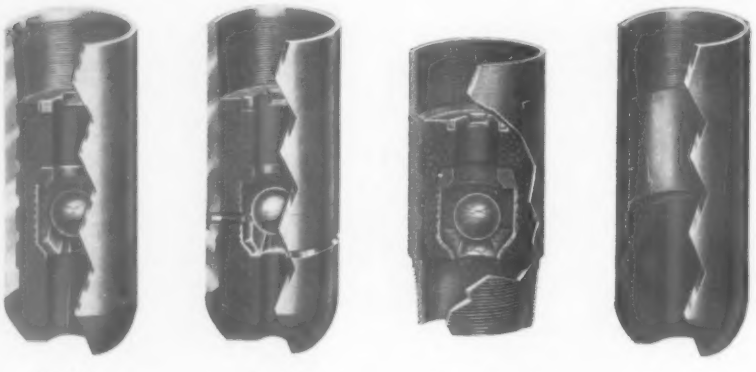

FIG. 302 FIG. 322 FIG. 401 M&F FIG. 202

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chemical reactions producing eye irritation, vegetation damage, and similar associated effects.

While it is true that atmospheric conditions dictating the volume into which pollutants may be dispersed are of prime importance to any air pollution problem, it should be recognized that the presence of stable air conditions, or atmospheric temperature inversions, is not limited to the Los Angeles area.

Certainly, it is not true that the mountains surrounding the Los Angeles basin are of significant importance to the retention of air pollution in the area. It is, rather, the vertical limitations placed on contaminant dispersal and the low average wind speeds in this area which result in limited horizontal distribution during critical morning hours.

Although these conditions occur with great frequency in the Los Angeles area, they may be expected to be a part of the climatological features of almost any area so that, given sufficient quantities of air contaminants injected into the atmosphere, any large urban area could expect photochemical smog of the Los Angeles type to occur . . .

S. Smith Griswold
Air Pollution Control Officer
Los Angeles

Varying wildcat wells

Dear Sir:

It is appropriate that I answer the criticism made by George G. Shearrow, Ohio Geological Department, appearing in your They Say column (OGJ, April 27, "Plenty of Ohio Statistics," p. 65).

Mr. Shearrow refers to the three sources of statistical data for Ohio. These are not named, but it is assumed that they are: Ohio State Division of Geological Survey, The Oil and Gas Journal, and AAPG Committee on Statistics of Exploratory Drilling. I am now serving my third year as chairman of the latter committee.

The differences in statistics for the State of Ohio, or for the United States as a whole, are entirely dependent upon the classification of wells drilled. The first procedure of the statistician is to determine whether the well is a routine development well in an established field or an exploratory hole.

The latter may then be further classified (as is done by AAPG) into five classes: 1. New-field wildcats (rank wildcats) 2. Outpost or extension test 3. New-pool wildcat (drilling outside limits of proved area of pool) 4.

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Shallower-pool test 5. Deeper-pool test.

Our committee is concerned with exploratory wells, or those which we consider to be nondevelopment wells. Briefly, these are wells that are drilled either in search of a new and as yet undiscovered pool, or with the hope of greatly extending the limits of a pool already partly developed.

I only have access to Ohio drilling statistics of all three of the above sources for 1957. Under exploratory drilling these three show the following: Ohio Geological Survey lists six rank wildcats, The Oil and Gas Journal lists 15 wildcat wells, and AAPG lists 119 wells classified as follows: 7 new-field wildcats, 41 outposts, 58 new-pool wildcats, 8 deeper-pool tests, and 5 shallow-pool tests.

The committee members representing AAPG locally for Ohio have had nearly 10 years experience in compiling data for our annual study. They make a critical study of each exploratory well and further classify it according to certain standards used by the committee over a long period of years.

Personally, I feel no concern over the difference in statistics as compiled by different persons. I believe each set serves a useful purpose. Certainly The Oil and Gas Journal is to be commended in its current compilation and release of such data and its early release of statistical information in a January issue which is so useful to industry.

B. W. Blanpied
Chairman
AAPG Committee on Statistics
of Exploratory Drilling

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JULY

27-31 University of Minnesota, continuation course, techniques of chemical infrared spectroscopy, Minneapolis.

AUGUST

3-7 University of Minnesota, continuation course, chemical interpretation of infrared spectra, Minneapolis.

6 Southern Gas Association, American Gas Association, public relations roundtable conference, Heidelberg Hotel, Jackson, Miss.

7 Southern Gas Association roundtable conference on pipeline operation and maintenance, St. Anthony Hotel, San Antonio, Tex.

10-13 Society of Automotive Engineers, national West Coast meeting. Hotel Georgia, Vancouver, B. C.

10-28 Louisiana Polytechnic Institute, Lou-Ark section of AIME, graduate summer session in reservoir engineering, Louisiana Polytechnic Institute, Ruston, La.

12-15 Billings, Mont., Geological Society, tenth annual field conference, Disturbed Belt area of northwestern Montana, registration, August 12, Great Falls, Mont.

23-26 American Institute of Electrical Engineers, sixth electrical conference of the petroleum industry, Wilton Hotel, Long Beach, Calif.

24-25 North Dakota Oil and Gas Association, annual meeting, Grand Pacific Hotel, Bismark, N.D.

24-26 West Virginia University, annual Appalachian gas measurement short course, Morgantown, W. Va.

26-28 Pennsylvania Grade Crude Oil Association and Pennsylvania State University, twenty-first technical conference on petroleum production, Penn State campus, University Park, Pa.

27 Oil Centennial Day, Titusville, Pa.

SEPTEMBER

9-11 Pacific Coast Gas Association, annual meeting, Ambassador Hotel, Los Angeles.

9-12 Intermountain Association of Petroleum Geologists, annual field conference, western high Uintas, registration, September 9, Provo, Utah.

10-12 Magic Plains Oil Exposition, Borger, Tex.

14-16 Texas Mid-Continent Oil and Gas Association, annual meeting, Rice Hotel, Houston.

16-18 Wyoming Geological Association, field conference, Big Horn Basin, registration, Cody, Wyo.

16-18 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

17 Natural Gasoline Association of

OTIS CORROSION SURVEY SERVICES
AND A STEPPED-UP CORROSION MITIGATION PROGRAM
LET US REDUCE OUR WORKOVER COSTS
FROM $500,000 TO $179,000
ANNUALLY. HERE'S HOW WE DID IT.
FIRST, WE USED OTIS CALIPER SURVEYS — BOTH TUBING AND CASING—TO DETECT CORROSION IN OUR PIPE. FROM DATA SUPPLIED BY THE OTIS REPORTS, WE EVALUATED THE CORROSION PROBLEM IN EACH FIELD AND SET UP A REALISTIC WORKOVER PROGRAM. WE REPLACED CORRODED PIPE JOINTS BEFORE THEY CAUSED SERIOUS TROUBLE. THIS ELIMINATED MOST OF OUR EMERGENCY WORKOVERS.
SECOND, WE SCHEDULED PERIODIC OTIS CALIPER SURVEYS TO EVALUATE CORROSION INHIBITORS. WHEN WE'D CHANGE INHIBITORS, OR USE A NEW TECHNIQUE TO APPLY THEM, WE'D HAVE OTIS CALIPER EACH WELL BEFORE WE INTRODUCED THE INHIBITOR AND THEN AGAIN IN FOUR TO SIX MONTHS. THIS GAVE US A CHECK ON THE PROTECTION AFFORDED EACH JOINT OF TUBING IN OUR WELLS — FROM THE BOTTOM TO THE TOP—AND IMPROVED OUR OVER-ALL INHIBITOR PROGRAM.
HERE ARE THE PRIMARY REASONS WE PREFER OTIS' CALIPER EQUIPMENT: THEIR INSTRUMENT GIVES US A DIRECT MECHANICAL READING—LESS CHANCE OF DISTORTION. CLOSELY-SPACED SPRING-LOADED FEELERS PRESS AGAINST THE INSIDE WALL OF THE PIPE TO MEASURE THE PIT DEPTHS. AS PITS ARE ENCOUNTERED, DIRECT ACTION FROM THE FEELERS CAUSES A ROTATING STYLUS TO PLOT THE PIT DEPTH AND LOCATION ON A METAL CHART WITHIN THE TOOL.

America, Rocky Mountain regional meeting, Wyoming-Gladstone Hotel, Casper, Wyo.

20-23 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Rice Hotel, Houston.

21-25 Instrument Society of America, annual instrument-automation conference and exhibit, International Amphitheater, Chicago.

23-24 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division annual meeting, Roosevelt Hotel, New Orleans.

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Waggoner, Okla.

28-Oct. 1 American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

29-Oct. 1 National Association of Corrosion Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

OCTOBER

1-2 National Association of Corrosion Engineers, southeast region conference, Jacksonville, Fla.

2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, aircraft manufacturing forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association, annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 American Association of Petroleum Geologists, Southwestern Federation of Geological Societies, second annual regional meeting, Coliseum, Lubbock, Tex.

8-10 Exploration Drilling symposium, sponsored by University of Minnesota, Colorado School of Mines, and Pennsylvania State University, University Park, Pa.

8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton-Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

13-14 Seventh Annual Gas Measurements Institute, National Guard Armory, Liberal, Kans.

20-22 American Standards Association, national conference on standards, Sheraton-Cadillac Hotel, Detroit.

20-22 National Association of Corrosion Engineers, north central region conference, Cleveland.

20-22 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Sheraton-McAlpin Hotel New York.

22-23 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin section, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

23 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

26-27 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

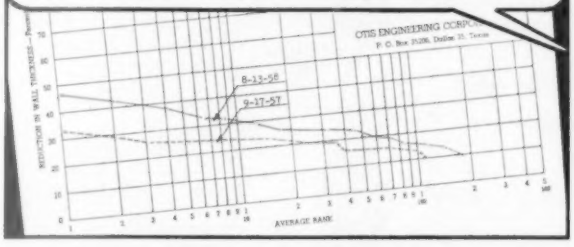
26-27 Independent Natural Gas Association of America, annual meeting, Westward Ho Hotel, Phoenix.

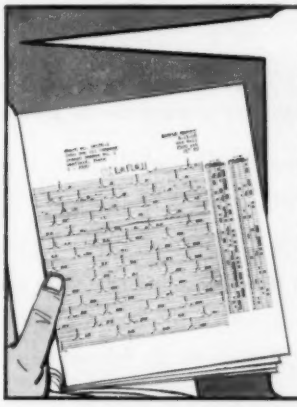
26-28 Society of Automotive Engineers, national transportation meeting, La Salle Hotel, Chicago.

28-29 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28-29 Armour Research Foundation of Illinois Institute of Technology, annual computer applications symposium, Morrison Hotel, Chicago.

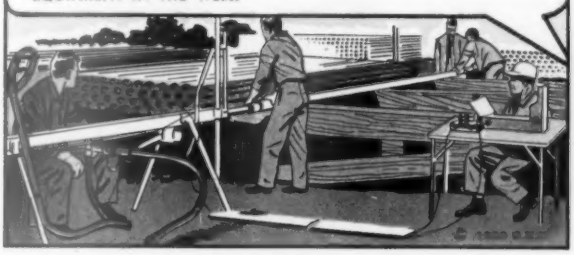
BESIDES LOCATING AND REPORTING DAMAGE TO PIPE THAT WILL CAUSE IMMEDIATE TROUBLE, OTIS' CORROSION REPORT ALSO INCLUDES A "PIT DEPTH RANK CHART" WHICH RANKS THE PIPE JOINTS ACCORDING TO THE DEGREE OF CORROSION DAMAGE DETECTED. THIS CHART ENABLES US TO EVALUATE OUR CORROSION CONTROL PROGRAM, AND HELPS US ANTICIPATE WORKOVERS AND PIPE REPLACEMENT REQUIREMENTS.





WE BELIEVE THE OTIS CALIPER SURVEY REPORT IS THE MOST COMPLETE WE CAN GET. IT INCLUDES — (1) A WRITTEN INTERPRETATION OF THE CALIPER CHARTS; (2) ENLARGED PHOTOCOPIES OF THE ORIGINAL METAL CHARTS TAKEN FROM THE CALIPERING TOOL; (3) A JOINT-BY-JOINT CLASSIFICATION SHEET, AND (4) THE PIT DEPTH RANK CHART. WHAT'S MORE, WE KNOW WE CAN RELY UPON THE INTERPRETATION GIVEN EACH OTIS CALIPER SURVEY.

THERE ARE OTHER WAYS YOU CAN USE OTIS' CALIPER SERVICE TO REDUCE WORKOVER COSTS. HAVE OTIS CALIPER PIPE IN THE YARD SO THAT YOU CAN SEGREGATE THE JOINTS FOR DIFFERENT USE. HAVE OTIS RUN ROD WEAR SURVEYS — AND CALIPER OLD PRODUCING WELLS YOU PURCHASE TO DETERMINE THE CONDITION OF THE PIPE, AND TO LOCATE SUB-SURFACE EQUIPMENT IN THE WELL.



OTIS' CORROSION SPECIALISTS CAN TELL AT A GLANCE AT THEIR CALIPER CHART THE DIFFERENCE BETWEEN PITS, MILL DEFECTS, TUBING COLLARS, OR JUST IRREGULARITIES IN THE TUBING WALL. AND OTIS CAN CALIPER TUBING OR CASING FROM 1¼" UP TO 9⅝". IF YOU WANT TO REDUCE YOUR WORKOVER COSTS AS WE DID — CALL OTIS. LET THEIR CALIPER SERVICE EXPERTS HELP YOU WITH YOUR CORROSION MITIGATION PROGRAM.

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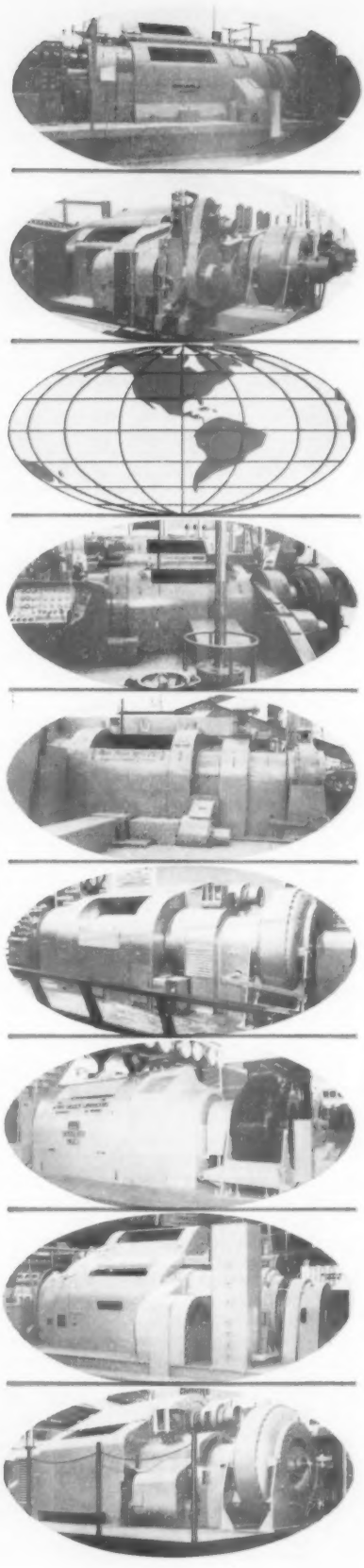

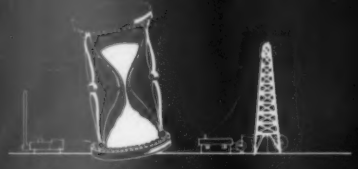

the Journal said...

50 years ago

July 20, 1909

Standard Oil Co. announces the development of petroleum butter, a new dairy-product substitute which it claims will last longer than real butter and not become rancid. It is brown and has the same consistency as lacteal butter. Manufacture will start first at the company's Wood River refinery, near Alton, Ill.

Expanding petroleum export trade is leading The Texas Co. to establish another European office, located at London. Its other foreign office, set up at Antwerp, Belgium, several years ago, will continue to serve Continental Europe.

A flood in the Grand River washes out Prairie Oil & Gas Co's trunk crude lines from Oklahoma to the East. The break, at a crossing near Dean's Lake, in Missouri, cuts off the company's crude runs, totaling more than 20,000 bbl. daily and forces the company to draw on reserves stocks east of the river.

25 years ago

July 19, 1934

Good showing of oil and gas in an Ordovician sand at 10,581-10,631 ft. in a wildcat drilled by Gulf Oil Corp. in Upton County, West Texas, threaten to rob Oklahoma of the credit of having the deepest oil-producing well in the world. The 7⅝-in. pipe Gulf is cementing at 10,300 ft. will be the longest casing string ever run. Only other Ordovician production in the West Texas-New Mexico region is the Big Lake field, 6 miles southeast in Reagan County.

Newly discovered Bosco field on Acadia-St. Landry parish line looms as one of South Louisiana's potentially largest producing areas. Major drilling program getting under way as 10 new operations augment 6 rigs already active with only the discovery well completed.

10 years ago

July 21, 1949

Newly formed Texas Illinois Natural Gas Pipeline Co., subsidiary of Chicago's Peoples Gas Light & Coke Co., proposes 1,000-mile, 30-in. natural-gas line from Houston area, on Texas Gulf Coast, to connections at Joliet, Ill. Cost estimated at $100,000,000.

Standard Oil Co. (N. J.) revises contract with Anglo-Iranian Oil Co., boosting Persian Gulf oil purchases to 800,000,000 bbl. over 20-year period.

Invasion pipe originally used in Belgium during World War II, goes into Lone Star Gas Co.'s new 214-mile extension gas-line system to the "Hill" country of middle-western Texas. Invasion pipe, unloaded from ships at Galveston, totals 308,900 ft.

JOURNALLY SPEAKING

Moving the Furniture

WE'VE MOVED around some furniture in the front rooms of the Big Yellow Book, remodeled the entrance foyer, and rehung some drapes and pictures.

That's a housekeeper's prerogative, of course. But, unlike some wife-type persons, we didn't do it on whim or just to have something to do. Our magazine architects planned it all out carefully with the purpose of serving the customers better.

Biggest change from the standpoint of all readers is the Table of Contents. This is now printed on both sides of a single cardlike sheet right inside the front cover.

That's the place for it, of course. But there are problems in remodeling a magazine just as there are in remodeling a house.

A few years ago we almost succeeded in getting the Table of Contents in the very front. But there is too much of it to go on one page and we had a strong notion that half of it would never be seen unless we ran it on a "spread"—that is, across two facing pages. So we had it on pages 2 and 3.

Then we started the Newsletter. Partly for mechanical printing and binding reasons and partly because we thought it would please a great many of our readers, we stuck it right inside the front cover. But then the Table of Contents wasn't up front where it ought to be.

What to do? Should we hide the Newsletter by putting it behind the Table of Contents? Or should we continue to hide the Table of Contents by keeping the Newsletter in front of it? No housewife ever chewed her nails any more when deciding where to spot the davenport.

All of a sudden—Eureka! We had the solution. We would put them BOTH in front. That's a neat trick if you can do it, and you can see for yourself how we did it.

We put the Table of Contents on a narrow sheet so you can see the edge of the Newsletter, on its familiar buff paper, sticking out beyond the margin. Now, no matter which one of the two you want to look at first, you'll find it right inside the front cover. That ought to please everybody—which isn't always easy to do in the publishing business.

Of course we had to abandon the "spread" idea for the Table of Contents. But this shouldn't be too bad. News items and departments are all on the front side, and engineering articles are all on the back side. (So far nobody has invented a way to save readers the work of turning a page.)

In doing that we lost the Masthead—the listing of editors and such miscellaneous employes as publishers, business managers, etc. But that was so big that we had it chopped up in two hunks anyway—a very untidy bit of housekeeping.

So now we have put all the Masthead together, with the editorial department listed at the top and everybody else crowded down at the bottom (you can guess what department designed this piece of furniture). You'll find it sharing space with the They Say page a little farther back in the book. Really the only reason for ever having the Masthead on the Table of Contents page was habit, but housekeeping habits are often hard to break.

The page you're reading now used to have the Business Masthead along its western border. With that moved, a perfect spot opened up for The Journal Said—that column of tidbits from the files of yesteryears. Every housewife has to have a whatnot or souvenir cabinet for heirlooms and memorabilia, you know, and we had been looking for a permanent home for ours for quite some time.

By taking The Journal Said out of the News Section, where it was always in the way and often got shoved around, we made more space for current news. Also, old timers interested in this feature will now always know where to find it.

We like this new arrangement of the furniture. What's more important, we hope you do, too, and that it won't take you long to find your way around when you come in the front door. After all, it's you readers that we are trying to please.

—Henry D. Ralph.

INTERPRETATION

Chinese writing or chicken tracks? It takes a chicken or a Chinaman to decide. That's the way it is with many oil well logs—difficult to decide if you have a well unless you're an expert. **But you don't have to be an expert to read a Welex log.** Welex's new interpretation techniques are designed to help you, the oil man, make your own decision with confidence. This is another reason why Welex, originator of jet perforating, now leads in revealing down-hole secrets of your well.

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ORIGINATORS OF Welex JET PERFORATING

General Offices: 1400 East Berry, Fort Worth, Texas
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The productivity issue behind the steel strike

CALL IT "PRODUCTIVITY," call it "featherbedding," call it what you will, the basic issue behind the steel strike is one that vitally concerns the future of our whole economy.

As in the case of many recent refinery strikes, the issue is not management's ability or willingness to pay higher wages. The real issue is whether the labor-cost component of a product should be increased. Where this will not increase productivity it must be recovered, sooner or later, through higher prices.

The issue shows up in demands that unions, in return for higher wages, abandon working rules that limit management's freedom to use the workers more efficiently.

HENRY FORD launched the productivity concept more than 40 years ago, though he never heard of the word. His unprecedented minimum wage of $5 a day brought predictions of economic ruin.

But there were two aspects of Henry Ford's concept of productivity that offset the high wage rate and prevented economic ruin—two aspects that seem forgotten today.

First, labor had to earn that $5 a day (with no featherbedding) by high productivity. This was achieved in large part by use of methods and machines devised and supplied by management.

Second, the benefit of lowered unit cost resulting from this increased productivity was not all kept by either labor or management; much was passed on to consumers in the form of low prices for cars.

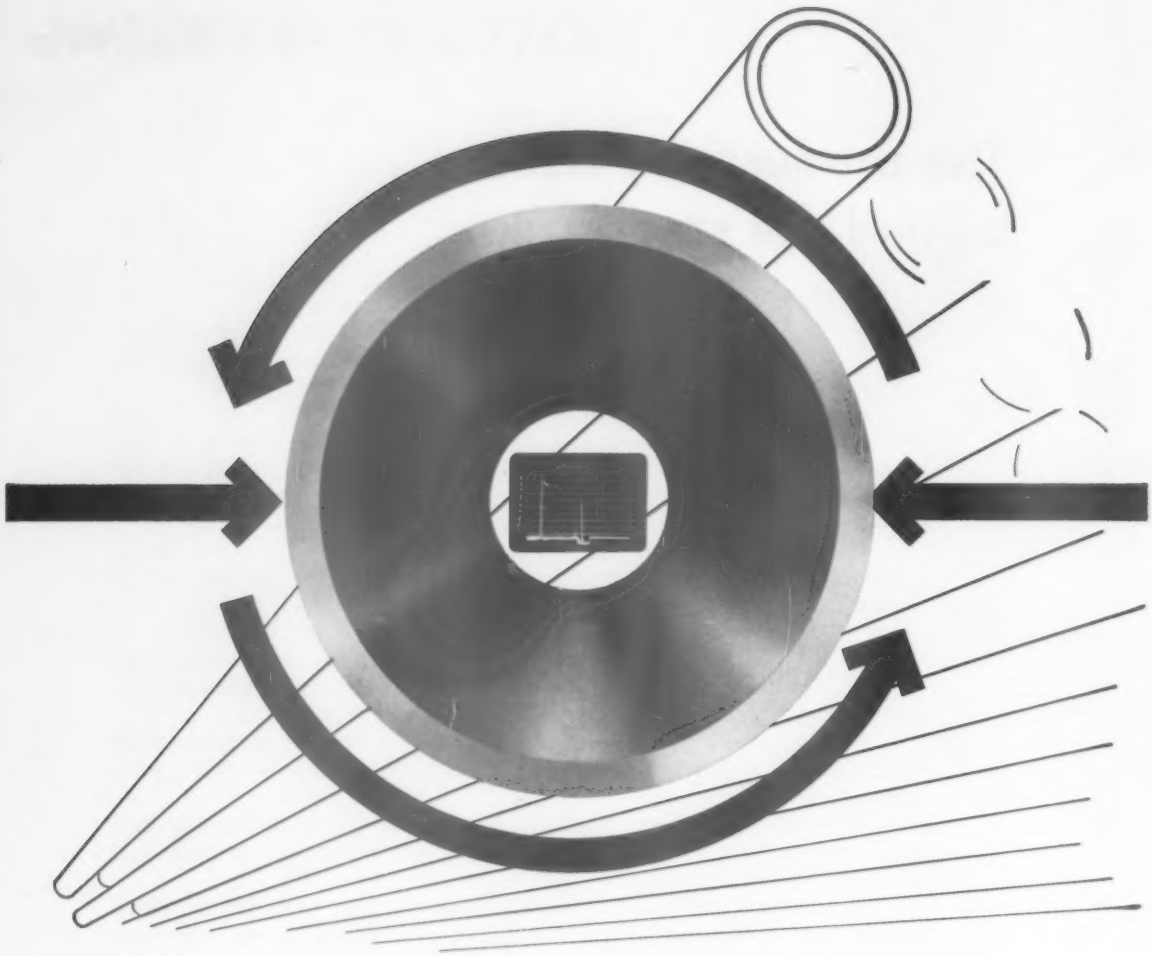
Today union leaders are prone to view company earnings as the measure of productivity, and argue that the company can afford to raise wages. This ignores the frequent fact that the increased efficiency (productivity) resulted entirely from capital investments. If labor is to get all the benefits without making any contributions there will be no incentive for technological progress.

But there is much more at stake than how labor and management shall divide the fruits of productivity. Regardless of which of those parties created it, a good share of the benefit should go to the public through lower prices.

ANY AVOIDABLE PRACTICE which raises operating costs without commensurate efficiencies that could reduce the unit price of the product is the equivalent of featherbedding. Both labor and management are guilty of many such.

Our national propensity for featherbedding in recent years has caused a fearsome inflationary spiral, is pricing us out of world markets, and threatens our ability to remain competitive with imports at home.

The solution is the kind of productivity, and the division of it, that benefits the whole economy through lower prices.



B&W LECTROSONIC

A New Name for Carbon Steel Heat Exchanger Tubing

Dependability Proved by Five Years' Extensive Field Service

You get substantial savings with this sounder, more uniform tubing

B&W LECTROSONIC—a new name for heat exchanger tubing—is manufactured under the most exacting methods of quality control in the industry, to give you new standards of dimensional exactness and uniformity, ease of installation, and dependability—plus dollar-saving economy!

You can save on installation time. Every tube fits right and rolls in easily because it's uniform in size and tolerances. It bends easily *with the weld in any position.*

The weld is checked five ways—including 100% ultrasonic inspection—to give assurance of dependability.

This superior quality tubing was developed to meet the needs of the petrochemical industry for a dependable electric resistance welded carbon steel tube that is easily workable, strong, and less costly than seamless tubing formerly required.

B&W LECTROSONIC Tubing is available now either direct or through distributors.

Write today for B&W Bulletin TB-431 for full information—or call your nearest B&W District Sales Office. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

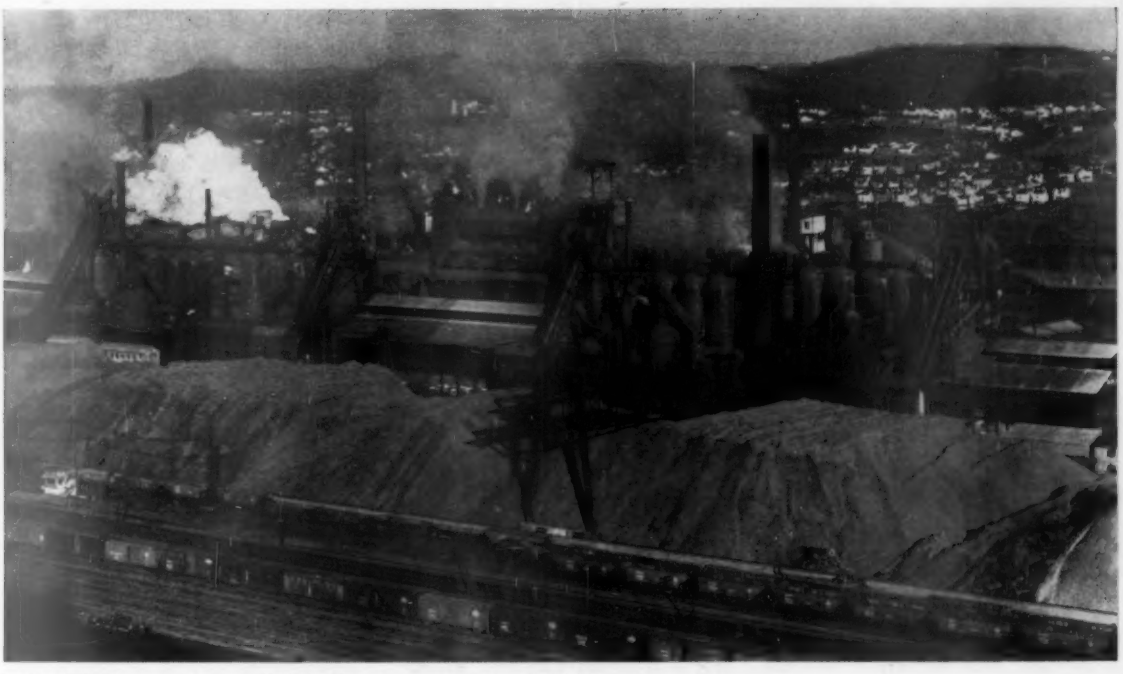
B&W

THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

TA-9033-WP4

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals



THE SMOKE is gone this week following the walkout by 500,000 workers, but . . .

Steel Strike Won't Slow Oil Activity

• After 30 days the smaller operators may start making deals and pricing used materials, but most big companies are comfortably fixed for a 3-month shutdown. At the moment it looks like business as usual for the oil man.

OIL MEN can ride out 90 days of a steel strike without feeling a pinch for vital supplies.

After that they may also be forced to start shutting down operations.

That was the consensus of the industry as steel mills shut down last week. The 500,000 workers who make the nation's steel walked out after weeks of negotiations over a new labor contract failed to produce an agreement.

Most oil men long ago had prepared for just such a day by laying in necessary steel supplies—tubing, casing, line pipe.

Their chief concern now: How long will it last?

Few insiders would even hazard a guess on the strike's duration. But most feel that before it continues long enough to hurt oil men, steel workers "will start getting hungry."

If this should prove true, the oil industry should be able to weather any possible steel trouble without damage to its drilling and production program for the year.

The outlook . . . Across the oil industry this appeared to be the situation last week:

. . . **Majors** held comfortable inventories which can carry them at least 90 days and likely longer.

Most of the majors bought heavily the first half of the year to replace depleted inventories and to stockpile against a possible strike. They now can reap the rewards of this buying policy by living off their stores in the pinch.

. . . **Independents** are in a more precarious position. Few of them have stockpiled heavily. Most will be dependent on supply houses after they deplete their thin present supplies.

. . . **Supply houses** have goods on hand to last 30 to 60 days and are prepared to take care of their own customers as long as supplies last.

. . . **A few other sources** of supply still remained available to prevent a complete shutoff of steel, although total volume admittedly will be only a drop in the pan.

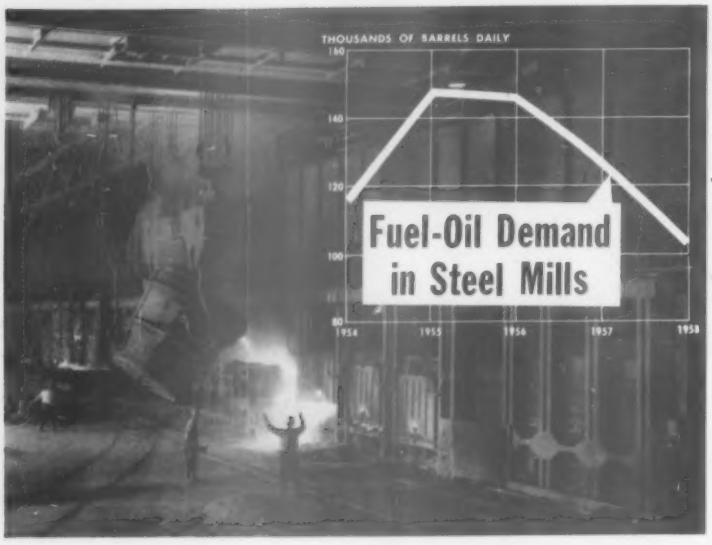
These include Lone Star Steel Co. near the oil country in Texas, Canadian mills, and foreign suppliers.

Lone Star's contract with the steel workers does not expire until September 7, which means it can turn out tubular goods throughout a strike of Big Steel.

Canadian steel mills also have 3-year labor contracts in effect and will not be shut down by the U. S. strikes. These mills have extra pipe-making capacity and for the last few years have sought to develop markets in the oil and gas industry below the border. The strikes will give them another opportunity.

Foreign tubular goods which have appeared on the domestic market in

Fuel-Oil Market Will Be Hurt by Steel Strike



AN IMMEDIATE effect of the steel strike on the oil industry will be a big drop in the demand for heavy fuel oil.

Steel makers accounted for 7.9% of the demand for heavy fuel oil during 1958. The steel industry used an average of 104,861 bbl. daily during the year.

Actually, fuel-oil demand in the steel industry has been dropping due to the wider use of natural gas in the steel industry, but steel's fuel-oil demand is still a big factor in U. S. refining. Demand for fuel oil by the steel industry hit 148,590 bbl. daily in 1955, but fell to 128,198 bbl. daily in 1957, and to 104,861 bbl. daily last year.

greater volume this year than previously also will be attractive. But American suppliers predicted that U. S. buyers could expect these foreign goods suddenly to become high priced with tougher terms.

Trading . . . One supplier predicted to the Journal that no oil man who really needs steel will go without it even in a long strike.

"You'll be surprised at the trades, deals or swaps you can make when you have to," he said. "The stuff may not be the size you want, but you can use it."

Another operator predicted that a good market will develop for second-hand pipe. The price will improve, and this will encourage salvage operators to step up pipe-reclaiming jobs.

Peak activity . . . The steel industry in the weeks prior to the strike made record shipments of casing, tubing and line pipe.

Mills in May shipped 1,337,140 tons of pipe and tubing and 443,181 tons of line pipe. Record shipments also were made of bar steel, construction and maintenance items, automotive steel, and finished steel.

Other industries, however, failed to enter the strike period in as strong an inventory position as the oil industry. A booming economy throughout the first half of the year required a large volume of steel and prevented large-scale inventory stockpiling.

One survey indicated steel stocks now total more than 21 million tons. This is 4 million tons less than were on hand at the start of the 1956 steel strike.

This could mean that consumer pressure to end the strike may develop quickly. Settlement of the 1956 strike after a month's duration was attributed to pressure from the auto industry which wanted to start tooling for the 1957 models.

There are two differences, however, about steel stocks this year. They reportedly are better balanced. Much of the steel also is being carried in finished goods. This is especially true of automobiles. Stocks of new autos at midyear were reported at more than 900,000 vehicles.

Afterwards . . . Many oil men openly expressed sympathy with the anti-inflation stand taken by the steel companies in the union negotiations that resulted in the strike.

Oil men have shown increasing irritation at the steady increase in their steel prices which have followed each round of wage hikes in the past few years.

Since 1950, steel wages have gone up by $1.25 an hour or 76% while steel prices have advanced by $47 a ton or 61%.

The steel industry estimates the steel worker is one of the world's highest-paid laborers. He gets $3.03 an hour wages plus 61 cents an hour in additional fringe benefits. Industry refusal to add 15 cents an hour to this labor bill under a new contract precipitated the present strike.

The steel companies held they could not grant any wage increase which would force them to increase prices. They claimed another wage agreement of this kind would add to the wage-price inflation push.

One result of the strike will be a pent-up demand for steel in the oil industry. Oil companies are expected at least to slow up their exploration and expansion projects. Drilling also may ease off in the weeks ahead. This means when the strike is over, oil operators again will be in the market for steel to get on with the projects.

If a price increase accompanies any ultimate settlement of the strike, oil men say you can expect the swing to small-diameter pipe to increase.

One supplier admits that growing use of slim-hole drilling and completions is beginning to show up as a substantial factor in tubular-goods manufacturing.

A situation is developing where the steel mills discover they have a surplus of rolling capacity for large-diameter pipe but are cramped to turn out smaller pipe. The mills lack sufficient flexibility to shift to meet this new pattern without buying new rolling equipment.

This trend shows up in the amount of tubular goods put into the ground. In 1957, slightly more than 12 tons of steel was used per thousand feet of hole drilled. This year the tonnage probably will drop as low as 9.5.

Slaughter Miscible-Drive Project Outlined

. . . by Atlantic in request for allowable. Company cites danger of oil loss by migration due to overinjection.

ATLANTIC Refining Co. last week revealed first performance data on its closely watched miscible drive in big Slaughter field of West Texas.

The industry has been highly interested in this operation since it is the first in which an operator has attempted to improve the areal sweep of the miscible drive by following the LPG and gas with water.

Atlantic started the full-scale project in the San Andres under its 1,247-acre H. T. Boyd lease in the west central part of the field in Cochran County in May 1958 (OGJ, June 16, 1958, p. 68).

The company last week asked the commission to grant a lease allowable for the project plus an allowable of 1,400 bbl. a day exempt from shutdown to balance overinjection which is taking place.

The company said the added allowable is needed to prevent threatening oil migration across lease lines.

Atlantic is injecting at Boyd through three widely dispersed input wells. To June 1 this year, the company had injected 4,087,000 reservoir barrels of fluids.

It had injected 100,000 bbl. of propane and 750,000,000 cu. ft. of gas in the 2 Boyd, 118,000 bbl. of propane and 750,000,000 cu. ft. of gas in the 9 Boyd, and 37,000 bbl. of propane, 385,000,000 cu. ft. of gas, and 455,000 bbl. of water in the 20 Boyd.

Oil bank formed . . . V. M. Hollrah, Atlantic engineer, told the commission that gas-oil ratios indicate that an oil bank is building up. And propane breaking through in places, he said, indicates displacement.

However, Hollrah said, the oil bank has built up near lease lines. This creates a migration hazard in that the lease now has much higher pressures than the offsetting leases.

While as much allowable as possible under present project rules has been transferred to line wells, still higher allowables are needed to prevent oil from the Atlantic lease from moving across lease lines.

Furthermore, under present operations, pressure in the San Andres under the Boyd lease will continue to rise, thus increasing the migration threat, Hollrah said.

This is because Atlantic is overinjecting at a rate of about 2.3 bbl. of fluid injected for every barrel of fluid produced. While injecting 4,087,000 bbl. to date, Atlantic has produced only 194,000 bbl. of oil and 943,000,000 cu. ft. of gas—leaving overinjection at 2,297,000 reservoir barrels.

This, Hollrah said, means oil is being drained from the lease, especially in the northern area. A definite oil bank, he said, has been built up around the 20 Boyd input well in the north part of the lease. Performance on the remainder of the lease is variable. Atlantic wants to continue the program. But continuing it calls for a high injection rate and changes in the rules. Interface pressure must be maintained at 1,300 psi.

The lease allowable would permit closing in some wells with high ratios. But production would never exceed injection rates. This, Hollrah said, would prevent Atlantic from draining any offset leases. The allowables of any one well could not exceed 150 bbl. daily.

Other operators appearing at the hearing concurred in the application so long as injection at the project should not fall below production. Among them were Texaco, Inc., and Honolulu Oil Corp.—both large acreage holders in the field.

Project aim . . . Atlantic tackled the Boyd project with the conviction that a miscible drive using a slug of propane chased by dry gas could not by itself be economically successful in competition with water flooding due to what Atlantic feels is the former's poor areal sweep.

The company feels, however, that it can improve this areal sweep by injecting water behind the gas bank to the point where the miscible drive would recover far more oil than a water flood. And it feels it can do this cheaply enough to make such a project attractive economically.

Foreign Investment Aids U. S.

. . . in cold war, Jersey Standard official says. He urges Government to encourage private investment abroad.

A NATIONAL policy to encourage foreign trade and investment was urged last week by the treasurer of Standard Oil Co. (N. J.).

Appearing before the Senate subcommittee on international finance, Emilio G. Collado described private investment abroad as one of the nation's most important weapons in the cold war.

He said it would be "unfortunate for the security of all Americans if the West's unique weapon, the private entrepreneur, which Russia can not match, were to be overlooked in the search for an effective U. S. foreign economic policy."

The subcommittee is studying the effect of private investment abroad on U. S. employment, profits, and markets.

In the case of Jersey Standard, Collado said, much of its investment abroad "is for trade between other countries with only a relatively small proportion of the oil trade crossing U. S. borders."

"The effect of our company's foreign-investment income on the U. S. economy is to increase foreign-exchange earnings," he said, "thus expanding the U. S. national income."

Collado noted that "difficult questions of import policy sometimes arise" where raw materials are available from both domestic and foreign sources.

"In regard to petroleum," he said, "Jersey Standard has always believed that a reasonable balance should be maintained between production and imports of crude oil. Such a balance is vital for our national security as well as for the well-being of the domestic oil industry."

In some cases, Collado said, "it may be deemed necessary to consider measures to cushion the full impact of import competition."

"But," he added, "I would urge that any compromise with a liberal import policy be approached with the greatest caution. The dangers inherent in any such compromise are that temporary measures have a way of becoming permanent, and that they will spread and reduce the efficiency of our whole economic system."

Texas Battles Oversupply With Another

• Fears of a break in crude-oil prices are eased as Railroad Commission again holds Texas production down. August allowable is set at 2.7 million barrels a day, up only slightly from July.

A BRIGHTER outlook has replaced the dismal feeling prevalent throughout the oil industry only a month ago that another break in crude prices was imminent.

Some of the gloom was lifted last month when the Texas Railroad Commission whacked back allowed production in Texas to 9 days, lowest level in a year.

By last week, fear that crude prices would crumble under the weight of excessive products stocks seemed to have disappeared when the Commission retained the 9-day allowable for August.

Initial August flow was set at 2,700,164 bbl. daily via a continuation of the 9-day producing schedule.

Due to new production added to the proration schedule so far in July, the August figure is 33,393 bbl. daily over the initial allowable for July and 7,794 bbl. daily over the figure in effect July 4.

Prospects are, under this allowable, that crude and product stocks will drop at a faster pace in August than in July to date.

Gasoline stocks at least appear to be on the wane. And with the heavy vacation motoring season now in full swing, it is likely that the draw on gasoline will continue—provided refinery runs are not stepped up too sharply.

Buyers optimistic . . . That the general situation has greatly improved was evident from testimony of major crude-purchasing representatives at the Texas hearing.

There was a conspicuous lack of groaning last week about burdensome crude inventories or the prospects of such. This is in sharp contrast to buyer testimony at the June hearing when the same companies were deeply concerned over the stocks situation. Some in fact were then faced, they said, with running completely out of crude-storage space unless a severe cut was made in July allowable.

Purchaser representatives appeared to feel generally that a 9-day pattern for August would leave crude stocks in excellent condition. Humble, Texaco, and Magnolia—all big buyers in Texas—reported they will use considerable stored crude this month.

ALLOWABLES BY DISTRICTS

District—	August	Change from July 4
1. Southwest	49,891	+ 332
2. Gulf Coast	101,853	+ 194
3. Gulf Coast	361,418	— 257
4. Southwest	182,266	+ 333
5. E. Central	31,408	+ 76
6. Outside East Texas	110,239	+ 16
6-E. East Eexas field	130,602	+ 1,151
7-B. N. Central	160,440	+ 1,035
7-C. W. Central	128,086	+ 365
8. W. Texas	1,049,339	+ 2,409
9. N. Texas	249,161	+ 864
10. Panhandle	145,461	+ 1,276
TOTAL	2,700,164	+ 7,794

Only Gulf, of the large buyers, is still adding to storage. On 9 days in August, however, Gulf expects to draw on its stocks to the tune of about 21,000 bbl. daily.

Prospects now are that a good many of the major buyers will be going into the spot market to fill their oil needs in August.

Spot buyers likely will include Humble, Magnolia, Sun, and Texaco. Others anticipate being about in balance on 9 days but may find they will have to spot buy also in August.

Gasoline in good shape . . . Coming as a surprise to some was testimony that gasoline stocks held by the majors also are in balance with desired levels.

Not all the purchasing firms gave data on their stocks of gasoline. All but one of those giving this information, however, said their stocks are in line.

Magnolia reported its gasoline inventory as "all right." Cities Service said its gasoline situation is "very comfortable." Phillips said its gasoline stocks are well in line and that it actually "is buying some." Texaco reported its inventory in balance.

Sinclair was the only company reporting excessive gasoline stocks.

Status quo urged . . . Purchaser nominations at the hearing were closely bunched and gave the commission solid ground for continuing the low allowable.

All told, nine crude buyers sought 9 days. Humble and Texaco asked for 10, while Sun sought 11. The three on the high side, however, indicated they could get along on 9 by going into the spot market.

Backing of independents for the 9-day schedule was solid, too.

E. L. Wilson of Dallas, representing 30 Dallas-area producers, urged "holding the line" to consolidate gains made in the past few weeks. Some Texas producers, he said, object to this on grounds that "Texas is holding the umbrella over the other states and paying a stiff price in lost markets for its oil."

However, he said, steps are being taken to persuade one of the states with an allowable considerably "out of line" on the high side to do its share to get the industry back in better shape by cutting its allowable.

"Also," he said, "if we remove the umbrella, we may get awfully wet ourselves."

Strikes force proration . . . Indiana Oil Purchasing furnished somewhat of a surprise at the hearing when it was able to nominate for a 9-day schedule despite strikes at three of its refineries.

R. F. Pielsticker said, however, that the nomination was made on the hope and assumption that the strikes idling refineries at Texas City, Tex., Sugar Creek, Mo., and El Dorado, Ark., would end by August 1.

If they do not, how much oil the company could take would depend on how much it could sell to other purchasers, he said.

Pielsticker reported that the company had been forced to prorate pipeline connections supplying oil to the Texas City refinery operated by American Oil Co. Currently, it is able

9-Day Month

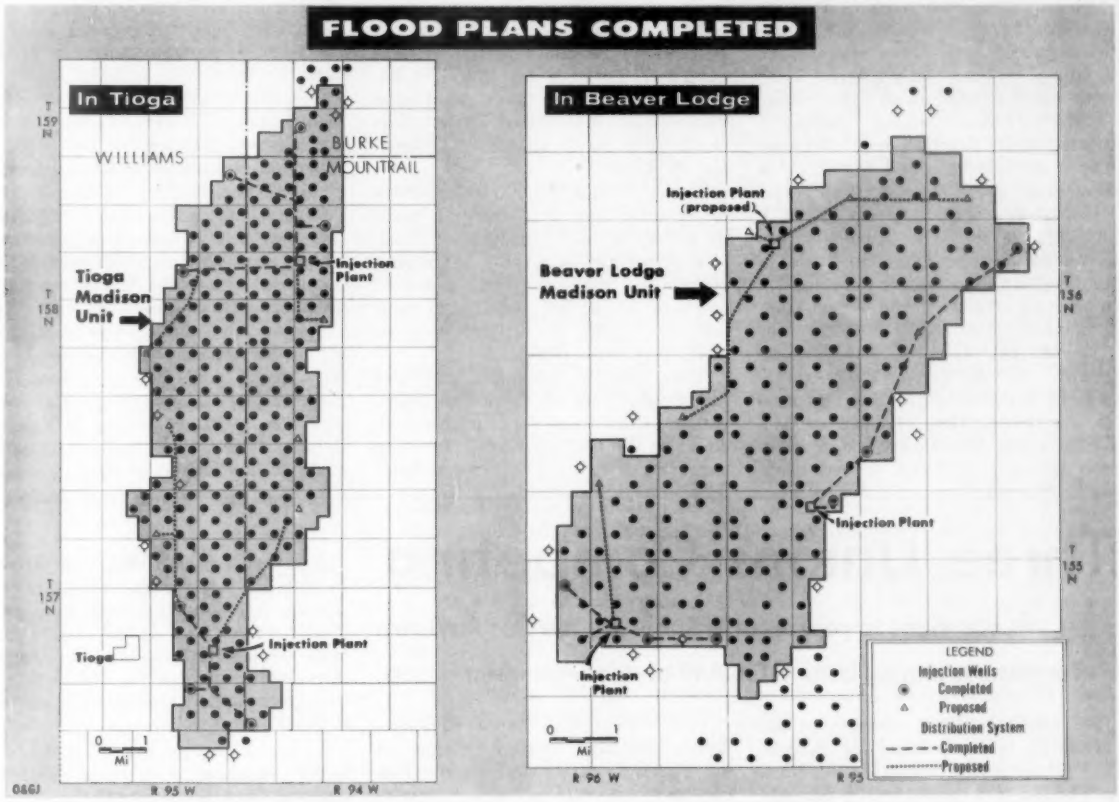
to take only 40% of the allowable from these connections.

Indiana Standard organization has been able to keep two of the three struck refineries in partial operation through use of supervisory personnel. Runs, however, total only about 70,000 bbl. daily, compared to a capacity of the three plants of around 260,000 bbl. daily.

Steel strike could hurt . . . Another strike, like that under way in the steel industry, was brought up at the hearing as a possible adverse influence in a brightening oil-marketing situation.

Prompted by a question from the commission as to the effect of the steel strike on oil demand, a spokesman for Texaco said his company doesn't feel the oil industry will be hurt badly unless the strike is of long duration.

However, if a long steel strike should occur, he said, the industry would be cut off from a large outlet for fuel oil. It would also be hurt when thousands of steel workers start cutting back heavily in their traveling and thus their purchases of gasoline.



Big Recovery Expected in Tioga, Beaver Lodge

A GO-AHEAD SIGNAL has been given on completion of another phase of the $7-million repressuring program in the Tioga and Beaver Lodge fields of North Dakota.

Operators have authorized:

. . . **Addition** of seven injection wells in Tioga and six in Beaver Lodge.

. . . **Doubling** the pumping capacity of four water injection plants.

. . . **Construction** of a third injection plant in Beaver Lodge field, for a total of five in the two units.

Pressure maintenance began last January through seven wells in Tioga and six in Beaver Lodge. Only the 8,300-ft. Madison lime is affected. Two plants have been operating in each field, each with two pumping units. Two additional units are being added to these plants, and four pumps will be installed in the new injection plant.

Amerada Petroleum Corp., operator for the 22 companies and individuals having interests, expects to be injecting 93,000 bbl. of water daily at peak operation. The original four plants are injecting 15,000 bbl. daily.

To date, about 43,400,000 bbl. of the estimated original oil in place of 358,000,000 bbl. has been produced in the two fields. Ultimate recovery with water flooding is estimated at 258,000,000 bbl. or 72% of oil in place, compared to 132,000,000 bbl. by primary means. There are 458 Madison wells on the 40,436 acres in the units. Beaver Lodge was discovered in 1951 and Tioga in 1952.

Operators expect it may be November before benefits of the flood will be reflected in production results.

Engineers estimate the peripheral injection project may return 18 bbl. of oil for every $1 invested in repressuring. It is the largest pressure-maintenance project in the Rocky Mountain area. Amerada owns 86.5% of Beaver Lodge and 84.4% of Tioga.

Texaco Adds Another U. S. Company

• Acquisition of Paragon, big East Coast fuel-oil firm, is fourth big Texaco buy in this hemisphere in 3 years.

TEXACO, Inc., is moving steadily along a determined course to strengthen its operations in the Western Hemisphere.

This trend is pointed up by Texaco's acquisition last week of Paragon Oil Co. Paragon will be the fourth major addition in 3 years to Texaco holdings in this hemisphere. Their total cost has been about $1¼ billion.

The Texaco buying movement started when Texaco bought Trinidad Oil. Last year it added Seaboard. A few weeks ago it announced an agreement to buy Superior Oil Co. (OGJ, June 29, p. 39). The principal properties of all four companies are in the Western Hemisphere except for a marketing affiliate in the British Isles.

Texaco paid $176,400,000 for Trinidad Oil, $241,500,000 for Seaboard. An estimated $765,000,000 will be involved if the Superior deal is completed. This adds up to $1,182,900,000. While the price of Paragon was not disclosed, it was probably enough to push the total for the four companies to around $1,250,000,000.

The pattern . . . Here's how Paragon could fit into the developing picture.

It is a large marketer of fuel oil, particularly residual, on the Eastern Seaboard. Texaco's acquisition of Superior would give it a substantial volume of Maracaibo crude. This crude is a major source of residual for the U. S.

Texaco, with a 115,000-bbl. refinery in Trinidad and a 20,000-bbl. plant in Cuba, is in a ready-made position to process Superior's Maracaibo crude. And Paragon, with an import quota of 57,705 bbl. daily, is in position to dispose of a large slug of resid from both plants.

Thus Paragon, providing an outlet for residual fuel oil refined in Trinidad and Cuba from Venezuelan crude, could be the last piece in an intricate corporate design. Other products from the Pointe-a-Pierre, Trinidad, and Santiago, Cuba, refineries could supply markets in the West Indies and in Central and South America.

Texaco's refinery at Santiago is a brand new plant. The refinery at Pointe-a-Pierre is undergoing substantial expansion. Some estimates of future consumption in Latin American markets foresee an annual increase of as much as 7 to 8%. Thus, it appears, there will be a growing market for Texaco's growing output of products.

Significance . . . Texaco's buildup in the Western Hemisphere could be a reflection of any one or all of a series of developments.

Most significant would be the increasing Latin American demand which could be supplied most economically with Latin American crude processed in local refineries.

Another may be a potential lessening in the importance of Middle East oil. More than 80% of Texaco's Eastern Hemisphere production last year was in Saudi Arabia, Iran, and Bahrain Island. This crude, however, could be outflanked in the European

Three Unions Competing

. . . to win right to represent Humble workers at Baytown

Teamsters running behind OCAW and independent group.

THE ORGANIZING strength of the Teamsters union, bidding for recognition in the Jersey Standard refineries, will be put to a rugged test in the next 2 weeks at Baytown, Tex.

Workers at the Humble Oil & Refining Co. will have three unions to choose from when they vote on a bargaining agent August 6 and 7. And the Teamsters of Jimmy Hoffa have entered the campaign with probably the fewest supporters of the three.

The Oil, Chemical and Atomic Workers Union (AFL-CIO), strongest in the refinery field, petitioned for the election with signatures of 30% of the 3,300 affected workers. The employes have been represented for 21 years by the Baytown Employes Federation, an independent union which also will be on the ballot.

The teamsters entered the contest by obtaining signatures of 10% of the workers.

A fourth choice also will be on the ballot—no union at all.

The National Labor Relations Board last week held a hearing on the election petition and set the August 6-7 date. If no union gets a majority of the votes, a runoff election between the top two will be held August 20-21.

Initial try . . . The Teamsters made their first foray into a Standard Oil Co. (N.J.) refinery by starting an organizing effort at the Esso Standard Oil Co. in Baton Rouge.

An election on a bargaining agent at the Esso refinery has been stymied because of Teamster charges to the NLRB of company violations in bargaining matters. Hoffa himself went to Baton Rouge last spring to encourage Teamster affiliation.

Esso workers currently are represented by the Independent Industrial Workers Union, an independent union. An election petition has been filed by the Baton Rouge Metal Trades Council.

Last week the IIWU president, Marvin H. Holley, Jr., said he is resigning his job and will join the Teamsters to start a new Teamsters local. Holley has supported the Teamsters while acting as the IIWU president. He invited Hoffa to make the Baton Rouge speech.

Strike situation . . . Meanwhile, a strike of OCAW workers at the American Oil Co. refinery at Texas City continued last week with no sign of ending. Neither side indicated that bargaining would resume.

The employes struck the plant July 1, but supervisors have kept it partly operating.

The two sides have criticized each other, but picketing has been peaceful. The principal strike issue is work assignment and job classification.

Pickets also remained at Amoco's 40,000-bbl. El Dorado, Ark., refinery. It was struck July 1 by 373 OCAW members over issues similar to those in the Texas City dispute.

A threatened strike at Lion Oil Co.'s El Dorado refinery was averted by a new 2-year contract giving workers a 3% wage increase.

The 280 members of the Interna-

market by oil from Algeria and Libya which may soon start moving to market in volume.

Political and economic stability of the West may be a final factor. Political disquiet of the Middle East and the disposition of countries there to press for a bigger share of the oil dollar tend to make the Western Hemisphere a more secure and comfortable place to invest for the future.

These possible influences represent views of outside analysts. Texaco, itself, attributed none of these conditions to its series of purchases. Its announcement merely said the purchase "will enable Texaco for the first time to engage directly in the fuel-oil business in the large East Coast market."

Paragon is a distributor of home and industrial fuel oils and other petroleum products in the Maine-to-Maryland area. It has headquarters in Long Island City, N. Y. It operates a small fleet of tankers and through its affiliate, Paragon Oil Burner Corp. of Mineola, N. Y., is engaged in the manufacture of oil burners.

Henry I. Schwartz, president of Paragon, and his four brothers associated with the company, will continue in the business in the employ of Texaco.

tional Union of Operating Engineers had voted for a walkout, which was headed off by the agreement.

The new contract provides a 6-cent-an-hour across-the-board wage increase retroactive to July 6 and an automatic 8-cent-an-hour general wage boost effective July 6, 1960.

The Sugar Creek refinery near Kansas City, Mo., of Standard Oil Co. (Ind.) was still strikebound, but the plant was being operated at about 25% capacity by management personnel.

Working conditions also is the issue in the strike by 750 OCAW members at the 76,000-bbl. refinery.

After supervisiory personnel began running crude oil at the rate of 20,000-bbl. daily, the OCAW local president, K. W. Kleihauer, charged the supervisors are "inexperienced and unqualified" and have created a highly dangerous situation.

P. C. Livesay, refinery manager, said supervisors with many years of operating experience are running the crude side of the combination crude-running and coking unit, which has a normal capacity of 36,000 bbl.

"We are completely confident of the ability of our supervisors to run the unit safely," Livesay said.

watching WASHINGTON

Joe Reilly

• Ruling leaves gas case more muddled than ever . . .

THE SUPREME COURT raised more questions than it answered in the CATC case.

In sending the case back to the Federal Power Commission, the court gave little hint how far or how fast it expects the commission to go in regulating gas producers.

After three rulings by the FPC and one ruling each by the Third Circuit Court of Appeals and the Supreme Court, producers still don't know what price they will get for their gas. The sale has been under a legal cloud ever since deliveries started. That was a year ago this month.

There is no assurance that a fourth ruling by the FPC would be more acceptable or more enduring than its earlier rulings.

Effect of the Supreme Court ruling was to vacate the FPC order granting certificates to the producers to sell gas to Tennessee Gas Transmission Co. In reconsidering the case, the FPC is cautioned to make "a most careful scrutiny" of the initial rates set by contract.

THE IMPLICATION is that the FPC might decide to grant conditional certificates if there is insufficient evidence to uphold the original rates. This the commission tried to do. In May 1957 it approved certificates which would have reduced the initial rate from 22.4 cents per M.c.f. to 18 cents.

The commission also tried to grant temporary certificates. These would have left prices to be set later.

Neither conditional nor temporary certificates were accepted by the producers. Their contracts gave them the right to cancel the sale if they were unable to get satisfactory certificates. They appeared about ready to take advantage of the escape clause when the FPC approved permanent certificates rather than have the gas lost to the interstate market.

As a result of the Supreme Court ruling, the FPC, the pipeline company, and the producers find themselves in a worse quandary than they were in 2 years ago.

The FPC now faces the task of reopening the case to consider the price question. This may involve the admission of new evidence. In that event, the case could drag out for months.

Tennessee Gas has spent millions of dollars for new pipeline facilities to handle the big offshore gas supply. Further expansion, part of it approved by the FPC, is based at least partially on the newly acquired gas reserves.

THE PRODUCERS—Continental, Atlantic, Tidewater, and Cities Service—still have no valid certificate for the sale of their gas. But since deliveries have started, FPC staff members contend that the reserves are committed to the interstate market. They argue that service cannot be stopped without FPC approval, and they can cite at least one court case upholding the FPC when it refused to allow a non-certificated producer to abandon service.

No official action has been taken yet to enforce the Supreme Court order. Parties to the suit were allowed until July 17 to file for a rehearing.

The court mandate was held up until after the deadline. Presumably, the old FPC certificates will remain in force until officially withdrawn.

If the commission decides to seek new evidence, the case probably will not be heard at least until September.

Up to last week, producers had not indicated what their next step would be. During oral argument before the Supreme Court, one of their attorneys pointed out that they did not consider themselves under FPC jurisdiction if they had no valid certificate.

If the opposite view prevails, the producers will be at the mercy of the FPC and the courts. They may be forced to sell gas against their will, and the sale may be at prices they previously had turned down.

FRONT VIEW . . . Manned by just one employe, this Knox portable filling station at a Garland, Tex., industrial area just north of Dallas sold 1,325 gal. of gasoline during a typical day last week. That was more than the volume sold on the same day by a permanent-type station—with 12 pumps and 5 men—operated by the firm in Dallas.

Filling Stations Are on the Skids—They

• Independents come up with another innovation in gasoline marketing—skid-mounted, portable stations. If the location isn't too good, the pick-up station can be ready for move to better site in less than hour.

INDEPENDENTS, pushing hard to hike gasoline sales and cut overhead in the face of prolonged fierce competition and low prices, continue to put most of the spice into oil marketing.

Recently American Petrofina Co. of Texas set what had been a relatively staid and convention-bound marketing business on its ear in an Oklahoma City suburb by taking gasoline to autos rather than waiting for them to come after it (OGJ, Dec. 8, 1958, p. 49, and May 18, 1959, p. 164).

The motoring public in that particular shopping center was immediately enchanted with the mobile station. And Petrofina now is starting to make hay with similar units in other cities.

Now, another enterprising independent, Knox Oil Co. of Texas, also headquartered in Dallas, is doing well with another marketing innovation—a portable station.

Knox reports a booming business in East Texas cities with two types of "pick-up" stations—one completely portable and the other semiportable.

The only difference between the two is that gasoline tanks of the latter are buried, whereas those of the completely portable station are skid-mounted.

The Dallas company now has six of these stations in operation in Dallas, Garland, Mesquite, and Tyler, Tex., and is rapidly building and installing more. Two are setting up now in Garland and Waco. Two more will be opened soon in Waco. And "the door is wide open for expansion into other cities," a Knox official told the Journal last week.

"How fast we expand with these units is dependent on how fast we can build them," he said.

This would lead you to believe that Knox is making pert profits from these stations—and if you did believe that, you'd be right.

Company officials won't talk about just how big the profits are. But they admit the portables are money makers. And the Knox expansion plans show the firm's faith in the future.

What they are . . . The pick-up units completely chuck out the window the "super market" approach to oil-products selling.

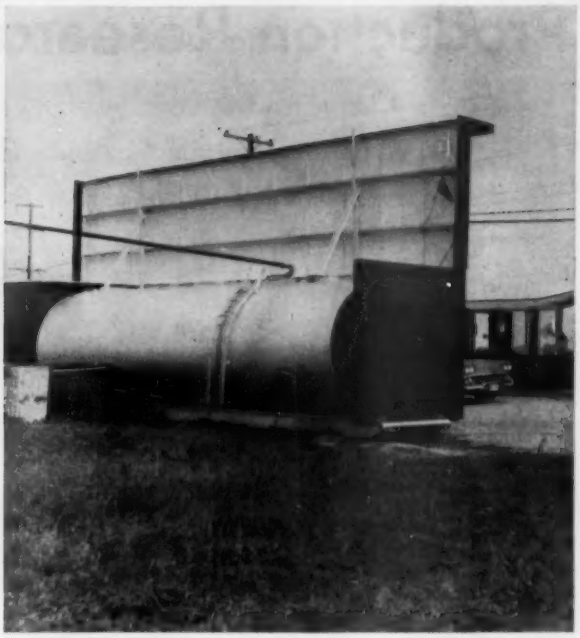
They don't offer tires, batteries, or accessories. They don't offer wash jobs, grease jobs, polish and wax jobs, minor mechanical repairs, or even oil changes. They simply sell gasoline and motor oil, plus a little antifreeze in the winter.

They operate with a minimum of equipment and personnel.

The completely-portable job has two skid-mounted units. The station proper—including four pumps, a 6x4 ft. "office," and space for a couple of racks of motor oils—occupies a 35x5-ft. skid.

A second 35x5-ft. skid totes a compartmentalized, 10,000-gal. gasoline tank. The tank's two compartments hold roughly 7,000 gal. of regular and 3,000 of premium grade gasoline. Fixed snugly to both tank and skid—

CLOSE UP . . . Skids under pumps and office enable Knox to pack up station and load it on trucks in half an hour—ready for a move to new location.



BEHIND THE SCENES . . . Gasoline tank, also skid-mounted, is shielded from motorists' view by large billboard advertising Knox gasolines.

Move Fast

and effectively screening the tank from customer eyes—is a huge, billboard advertising Knox gasolines. When a truck picks up the tank, the sign goes with it.

How they make money . . . The portable unit can tick off quite a number of advantages over a conventional station. Some of them are:

. . . Low initial cost. It costs only around $10,000 to put in one of the Knox stations ready to operate. This compares with costs of up to $100,000 or so for many modern, permanent stations. All Knox needs to do to set one up in business is get some land, grade the dirt level, and throw some chert or gravel on it to make a drive.

. . . Low operating cost. Since the station has only four pumps and sells only gasoline and motor oil, only one man is really needed to operate it. This compares with a labor force on a "super" service station of six or more men. Since there is little equipment, there is little upkeep and maintenance, too. Since it doesn't handle T. B. A. or other sideline items, the portable has no money tied up in inventory in these things.

. . . It can move. Unlike a conventional station, the portable can quickly pick up and move to a better spot if business doesn't come up to expectations at its first, or second, or third location.

The station site is always leased. And lease terms usually provide for quick cancellation so that a move can be made speedily if necessary.

Besides being more flexible, leasing land for a station site is much cheaper. In Dallas for instance, a Knox executive says, land can be leased at reasonable rates whereas "going prices for buying land have gone so high as to become prohibitive."

It takes only about half an hour to shut-down an operating Knox portable and get it aboard trucks ready to move. The company simply disconnects the lines from the pumps to the tanks, stows the motor-oil racks plus the drive markers and flags in the office, picks up the smaller signs, pulls the two skids onto the trucks—and the station is ready to go.

On the semiportable units, where the gasoline tanks are buried, it takes a bit longer—perhaps a couple of hours.

Others to jump, too . . . Other independents have recognized a good deal when they saw it.

Knox Industries, Inc., Enid, Okla., a firm with no corporate relationship to Knox Oil of Texas but with essentially the same ownership, also now has half a dozen portables of the same type operating in Tulsa and other Oklahoma communities.

And Webb Oil Co., also of Dallas, has come up with a somewhat different model.

Glance Back . . . then Look Ahead

WHAT'S in store for the oil industry during the second half?

Journal editors supply the answer in a special 40-page midyear review and forecast in next week's issue. The significance of activities and events during the first half and what to expect the rest of the year are highlighted in the special report.

The report covers all bases with interpretative articles and statistical reports on drilling activity, exploration trends, plant construction, supply and demand, the Zwerdling natural-gas decision, U. S. and foreign production, imports and exports, product prices, and other phases of the industry.

Don't miss the Midyear Report in the Journal's July 27 issue!

Production Research Picks Up Speed

• Preliminary work by TPRC paves way for increased efforts at solving mysteries of producing solution-gas-drive pools. A successful project would mean a major advancement in oil-production technology.

Robert J. Enright
Dallas District Editor

RESEARCH work now advancing at the University of Texas may, within the next few years, at last unlock the secrets of the enigmatic solution-gas-drive reservoir.

The project, tackled more than a year ago by the Texas Petroleum Research Committee, now is being pushed hard following completion of many preliminary runs which TPRC feels have proved that equipment and procedures are solid and reliable.

Success of the TPRC effort would mean a great breakthrough in oil-production technology. It would prove an immeasurable boon to the industry in its unending effort to get more and more of the total oil from known reservoirs.

Specifically, here's what TPRC hopes to learn by this project:

. . . How best to produce a solution-gas type pool. Presently there is no such thing as a maximum efficient rate of production for such a field. At least, there is no industry agreement on this point.

Many engineers contend that this type of pool must be produced slowly in order to get the most oil out. Others contend that rate of production makes no difference—the same volume will be produced no matter what the producing rate.

. . . When to flood a solution-gas pool. Industry disagreement is just as complete on this issue.

Some engineers argue that such a reservoir should be flooded before field pressure drops below the bubble point. Others say it is much better to wait until pressure is below this point and much of the dissolved gas has been released.

Still others say it all depends on the particular reservoir—sometimes one way is best, sometimes the other.

Not satisfied with this much, TPRC researchers are hopeful they will be able to say, too, what reservoir pressure—whether it be above or below the bubble point—should be maintained to recover the maximum volume of a given crude oil from a given reservoir.

It hopes to do this by correlating the physical behavior observed with the type of crude oil in a pool, paying attention to such crude characteristics as gravity and viscosity.

Dr. George Crawford
. . . director of research project.

From this, TPRC might be able to roughly classify various crudes into groups and come up with tables which would indicate at what pressure a flood should start and what pressure should be maintained for a crude in a given group.

. . . More miscible-drive know-how. Later on, TPRC will tackle a reverse problem—the physical mechanism of a miscible drive—where gas is going into solution with LPG or oil.

Here, TPRC wants to know how gas goes into solution and how it diffuses through the liquid phase, if this can be determined. It wants to find out the effects of the large number of forces brought into play at once in the miscible drive.

What, for instance, are the effects of the capillary attraction of the rock, the pushing force of the approaching gas, the swelling or retarding force of the liquid, the gravitational-segregational forces?

TPRC is not at all sure that it can come up with the answers to this one. But it will try.

The project is under the direction of Dr. George Crawford, assistant director of TPRC. It is being conducted by Robert G. Edgerton, research engineer for TPRC.

Here's the procedure . . . As part of the project, TPRC research workers built a device that enables them to see—for the first time—a model reservoir producing under controlled conditions.

To begin an experiment, all air is pumped out of the system. The system then is filled with brine which has been completely degassed via subjection to vacuum pumping for several days.

Pressure is hiked to about 200 psi. above the bubble point of a brine saturated with methane. Then, this brine is pumped into the reservoir under high pressure, flushing out the degassed fluid.

The methane brine in turn is displaced by kerosine saturated with methane, still maintaining a pressure 200 psi. above the bubble point of the fluid so that no gas can come out of solution.

Kerosine is being used instead of crude oil at first for two reasons. First, Crawford and Edgerton want to take advantage of extensive work already done on gas coming out of solution with kerosine under no-flow conditions. This has been done by Dr. Harvey Kennedy, one of two members of the committee at Texas A. & M. College, College Station, Tex.

Secondly, they first want to understand the physical mechanisms involved in gas coming out of solution in a liquid. They feel there will be no mechanical difference in the phenomenon whether crude or kerosine is used.

When they understand the mechanics, runs with various crude will be made. Then, TPRC should be able to ascertain the best time to flood a solution-gas pool containing, for instance, fairly dead oil, or one with lots of gas.

When the kerosine with gas in solution has been pumped into the tiny reservoir, TPRC has completed the first phase of the experiment—that of duplicating an actual reservoir containing connate water (brine) with gas in solution with the oil under pressure.

Then the real experiment begins. TPRC has the choice of running two basic experiments. As it reduces pressure toward the bubble point, it can close the valve on the input or

Miniature Reservoir Aids TPRC Researchers

A TINY model reservoir is giving oil scientists their first look at what happens in a producing oil pay zone.

The device—an industry first—enables TPRC research workers to actually see a model reservoir producing under actual conditions of reservoir temperature and pressure.

It took TPRC more than a year to build and test the apparatus and overcome the tremendous problem of adequate control of temperature and pressure.

The committee says the device is ready for research aimed at supplying answers to a host of questions about producing solution-gas-drive pools.

MOVIE CAMERA is trained on the small model reservoir, which is only 6 in. long, 1 in. wide, and 1 to 2 mm. thick. Keeping an eye on the device is Robert G. Edgerton, TPRC research engineer.

The setup . . . TPRC's model reservoirs are slabs of Torpedo sandstone cores, 6 in. long and 1 in. wide. They are diamond-ground until they are perfectly flat and only four sand grains (or about 1 to 2 mm.) thick.

With such a thin core, the TPRC technicians can actually see fluid movement in the rock pores.

The tiny reservoir is sandwiched between two thick slabs of glass. After several months of searching, Crawford and Edgerton found an epoxy resin cement which proved ideal for cementing the core to the glass. It furnishes a firm bond which prevents any fluid flow between the glass and the sand, yet penetrates less than one-quarter of a grain into the sand.

Fluid input and output ends of the reservoir and its edges also are tightly sealed to keep out air. The finished reservoir is encased in a stainless steel chamber, fixed in place, and connected into the fluids (any of several pressure cylinders), pressure, temperature system.

The TPRC cell is designed to handle pressures up to 10,000 psi. TPRC in this experiment has tested it in operations at 7,500 psi., however, and plans are to run the experiments at pressures up to about 5,000 psi.

An air bath, accurate to 0.1°, is being used to maintain temperature at the desired level.

The core is illuminated from behind so that fluid flow can be observed. Diffused light from a conventional auto headlight is used. The light source actually is in front of the reservoir. But the light is passed through two prisms to illuminate it from the rear.

Fixed staunchly in position just in front of the reservoir is a 16 mm. movie camera which records the action using a telephoto lens. The camera takes color pictures during a run at a speed of 64 frames per second. The film is developed and the movie projected on a large screen and run back at 16 frames per second—thus slowing up the action to a speed only one-fourth as fast.

fluid end of the reservoir. If it does, then it is studying not movement of the oil in the reservoir, just expansion of the oil. Oil movement can only be detected after gas bubbles start coming off.

The alternative is to open the inlet valve, putting the reservoir in contact with a large volume of expanding kerosine in the pressure cylinder and forcing oil movement through the core.

TPRC plans are to run no-flow experiments first, then progress to studies of gas coming out of solution when oil is actually flowing through the reservoir. It hopes to be able to complete both studies by the end of October.

Later on, the committee may increase the pressure drop across the core to stimulate what happens during production in the area of the pay right at the bore of a producing well. Crawford says this would be, in effect, a study of stripper action.

Pressure drop across the core for the experiments now under way will run roughly ½ psi.

Production flow rates from the output end range from about 6 in. to 1 ft. per day. Actual runs last from 30 to 45 minutes.

Recorded as data during the runs are: (1) The pressure drop across the cell; (2) Volume of production of oil and water—and gas as it begins to come out of solution; (3) Temperature; (4) Pressure on the inlet end.

Color plays big role . . . Multiple runs under duplicated conditions will tell TPRC exactly what is happening to each fluid present in the reservoir.

First runs use colorless brine and kerosine dyed a sudan red so as to see not only the gas coming out of solution but the effects of this on the oil.

Following runs will use green brine and colorless kerosine. This will show the researchers where the brine is, whether it is moving or bypassed, and how much there is of it.

In movies of the first runs, oil faithfully shows up as a red substance, while the water can't be seen. In the second the water shows up green and

Looking for answers . . . In addition to the three principal aims of the project, TPRC hopes to strip the mystery from the solution-gas-drive pool and help settle the industry arguments on how to handle this kind of field by answering three other important questions:

. . . How does gas come out of solution with crude oil in the reservoir?

Here it hopes to find whether the gas needs a nucleation surface or point to come out of solution under static, no-flow conditions. Also, whether a nucleation is required under actual flow through pores or whether expansion releases the gas. Where does the gas go after formed? Do the bubbles rise?

. . . How does this gas coming out of solution change? Does it block certain passages? Does it remove oil from pores that would otherwise be bypassed?

. . . How does the loss of the gas change the physical characteristics of the oil?

Dr. Crawford amplifies the first question in this way. "When gas starts coming out of solution in a container of liquid, you find that the bubbles collect around the edges and do not assemble. If there is a dissolved solid in the glass, such as sugar, the bubbles form around it—the sugar furnishing a nucleation point.

"We will take a sandstone with a liquid dispersed in the pores and see if the bubbles form clinging to sand grains or form freely in the rock pores.

"In the no-flow case, in which runs have just started, we expect to see the bubbles forming on sand grains. We want to study the places on these grains where the bubbles form to see if something on the sand is acting as a catalyst in their formation.

"When we start runs with flow through the reservoir, with all conditions duplicated, we want to see if the bubbles form at the same points."

A different benefit . . . Besides solving a large number of production riddles, Dr. Crawford has another motive in mind.

He puts it this way:

"One of the big troubles with oil education in high schools and colleges now is that students can't see what is going on underground.

"Through these experiments and with the film that results, we hope to come up with a series of good training films where students can actually see what happens in an oil pay zone when it is produced."

Bill to Boost Gasoline Tax Is on Docket

- **Committee chairman cool toward 1½-cent increase.**

Highway financing proposals are also to be considered.

FATE OF THE PROPOSED gasoline-tax increase may be determined by the House ways and means committee at hearings starting July 22.

Chairman Wilbur D. Mills (D-Ark.) has indicated the committee will consider President Eisenhower's recommendation for a 1.5-cent per gallon tax increase as well as alternate proposals to help finance the federal highway program.

There has been widespread speculation that Eisenhower and congressional leaders might compromise on a temporary tax increase of from 0.5 to 1 cent per gallon. But Mills, who has been cool toward the President's original proposal, still appears reluctant to approve any new taxes on gasoline.

In addition to tax proposals, the committee is expected to consider transfer of money from the general fund to bolster the highway trust fund, issuance of bonds to help finance the highway program, and possible deficit financing to continue the program on schedule.

The House public works committee has approved a bill to increase federal highway expenditures by $300 million this fiscal year to a total of $2.5 billion.

Road funds sag . . . At the projected spending rate, the nearly depleted highway trust fund is expected to be at least $500 million short this year. Over the life of the program, which is to continue to 1972, a deficit of about $13 billion is anticipated.

The National Highway Users Conference, which is among the many organizations opposing a tax increase, has pointed out that the prospective deficit is due largely to commitments made before the present highway act was passed and to the "antirecession" measure passed last year.

Expenditures through the current fiscal year will be almost 20% greater than the amount contemplated when the 1956 highway bill was passed.

Contrary to reports that have been circulated recently, the users conference says that the highway program will not "come to a halt" if Congress postpones action on the financing problem.

According to the NHUC study, expenditures from the highway trust fund would continue at more than $3.1 billion in fiscal 1960 and $2.8 billion in 1961.

Texas Eastern Cuts Shipping Cost for Propane

COST OF SHIPPING propane from Texas to Ohio via the Little Big Inch pipeline has been reduced about 20% from 82 cents to 66 cents per barrel.

The new tariff rate, filed with the Interstate Commerce Commission by the Little Big Inch Division of Texas Eastern Transmission Co., went into effect last week.

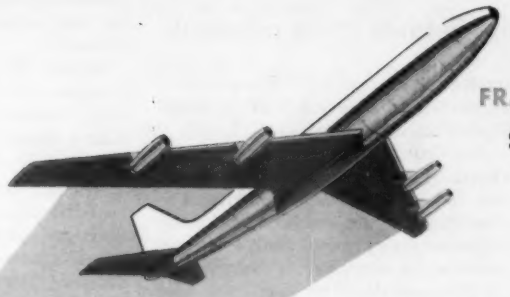
Texas Eastern announced that underground storage, refractionating and dehydrating facilities, plus truck and rail car loading racks have been built at the Todhunter terminal, near Middletown, Ohio. The charge for dehydrating propane and loading it has been set at 8 cents per barrel.

Three underground caverns of more than 20 million gallons capacity each have been completed at Todhunter and two others, each with 15 million gallons capacity, will be ready in time for the heavy propane season.

Texas Eastern also will create two underground storage caverns at Mont Belvieu terminal, near Houston. They will be water-washed to a capacity of 20 million gallons each in salt caverns at depths between 2,500 and 4,000 ft. Later, each may be enlarged to handle 40 million gallons.

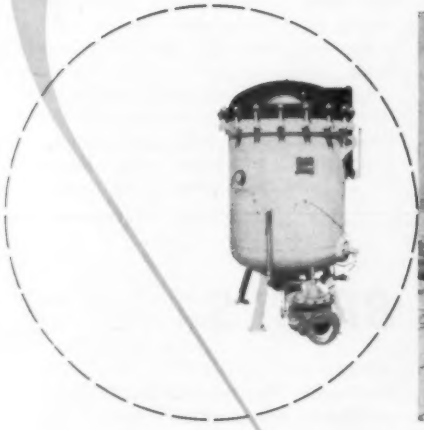
The company said charges for storage in Houston will be 6 cents per barrel for the first 60 days and 1 cent per barrel for each additional 10 days.

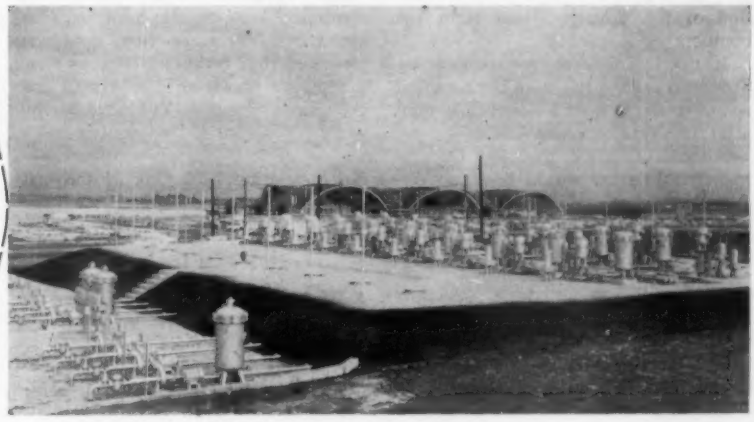
LAMBERT FIELD / ST. LOUIS



FRAM-WARNER LEWIS SEPARATOR/FILTERS SELECTED BY ALLIED AVIATION FUELING COMPANY

This fuel farm installation includes 21 Warner Lewis jet fuel separator/filters supplying fuel to the hydrant system at Lambert Field, St. Louis. The hydrant fueling carts are also equipped with Warner Lewis separator/filters. These units provide for highest efficiency in removal of water and solid contaminants at economical maintenance costs. These Warner Lewis separator/filters insure cleanest possible fuel for new turbo prop and turbo jet aircraft. For information on the complete line of separator/filters for mobile and stationery installations write Warner Lewis Company, Box 3096, Tulsa, Oklahoma.





- System design by J. F. Pritchard Co., Kansas City, Mo.
- Operated by Allied Aviation Fueling Co., New York City.

DIVISION OF FRAM CORPORATION

WARNER LEWIS COMPANY
BOX 3096 • TULSA, OKLAHOMA

Leasing Bills Approved

. . . by House and Senate subcommittees. Industry spokesmen went on record at hearings in favor of the proposals.

INDUSTRY spokesmen and government officials have lined up in support of proposed legislation to encourage oil and gas development on public lands.

Endorsed last week at separate hearings before House and Senate interior subcommittees were bills to increase acreage limitations on federal leases, extend primary lease terms, and protect innocent parties from lease cancellations.

These provisions are wrapped up in companion bills introduced by Sen. Joseph C. O'Mahoney (D-Wyo.) and Rep. Keith Thomson (R-Wyo.). Several other leasing bills also are pending before the subcommittees.

While approving most major provisions of the O'Mahoney-Thomson bills, the Interior Department favors an amendment to increase the minimum yearly rental under the Mineral Leasing Act from the present 25 cents per acre to at least 50 cents per acre.

George Abbott, Interior Department solicitor, endorsed a 10-year initial term for noncompetitive oil and gas leases, but he urged continuation of the present 5-year term for competitive leases.

If the initial term is extended, he proposed raising the minimum annual rental to more than 50 cents per acre after the first 5 years.

Abbott indicated that the Department of Interior would have no objections to combining the acreage limitations for leases and options on public lands outside of Alaska.

The O'Mahoney-Thomson bills would permit an individual or company to hold leases and options on up to 246,080 acres of public land in any state except Alaska and Hawaii. Not more than 200,000 acres of that total could be held by options.

Under present law, the lease limit is 46,080 acres in each state except Alaska, and the limit on options is 200,000 acres.

In the Senate hearings, Acting Chairman Clinton P. Anderson (D-N. M.) expressed surprise when he was informed that the O'Mahoney bill would permit an operator to hold the entire 246,080-acre limit in leases. At one point, he said flatly that "the bill's dead."

Industry backing . . . W. T. Blackburn, partner in Vaughey & Vaughey of Jackson, Miss., and Denver, defended the acreage-limitation provision as an "essential feature" of proposed legislation.

Blackburn is a member of the executive committee of Rocky Mountain Oil and Gas Association and is chairman of the public lands committee of Independent Petroleum Association of America.

"Theoretically," he said, "the idea of having one acreage limitation for leases and a separate acreage limitation for certain nonrenewable 3-year options may be all right, but as a practical matter, it does not work."

Whether or not options can be renewed "is a constant source of legal disagreement and in many instances results in a clouded title," Blackburn said.

Howard C. Bratton, a spokesman for New Mexico Oil and Gas Association, also urged a combined acreage limitation for leases and options. He said the present system "is a source of constant difficulty and uncertainty."

Earlier, the House interior committee approved a bill setting the combined lease-option limit in Alaska at 600,000 acres. Sen. Anderson indicated that he might seek to write a separate provision for Alaska into the more general O'Mahoney bill while it's before the committee.

No opposition . . . One of the least controversial provisions of the O'Mahoney-Thomson bills is that protecting innocent leaseholders from cancellation proceedings by the Interior Department. This section was endorsed almost without reservation by both industry and government officials.

About 200 parties are involved in complaints recently filed in Montana and Wyoming challenging leases which were alleged to have been fraudulently acquired.

The proposed legislation would prevent the cancellation of leases or options acquired "in good faith" even though previous holders may have obtained them illegally.

Cancellation proceedings have caused "chaos" in oil and gas production in public-land states, said Robert B. Laughlin, executive vice president of Rocky Mountain Oil and Gas Association.

"The title to practically every federal lease has been clouded," he said, "whether or not the same may now be in the hands of an innocent purchaser. This has resulted in a serious slowdown in exploration and development. Transactions cannot be consummated because titles cannot be approved. For the same reason, banks are forced to disapprove oil loans."

In explaining his bill, Rep. Thomson warned that development on private lands adjoining public leases also would be halted unless the "cloud" is removed from the title to federal lands.

Under his bill, he said, the Secretary of the Interior can cancel the lease of a guilty party and declare him ineligible to acquire federal leases for an indefinite period in the future.

PROCESSING BRIEFS . . .

Contract has been awarded Fluor Corp. for construction of an 8,000-bbl. fresh feed Thermofor catalytic cracking unit at the Shamrock Oil & Gas Corp.'s McKee refinery at Sunray in the Texas Panhandle. Work will begin late this summer. Completion is scheduled early in 1960.

Gulf Oil's new benzene plant at its Port Arthur, Tex., refinery is now on stream. The plant, consisting of a catalytic reformer and a purification unit, has a capacity of 30 million gallons of benzene annually.

Ceremonies dedicating a new digital computer center have been held at the Delhi-Taylor Oil Corp.'s 40,000-bbl. refinery in Corpus Christi, Tex. The Burroughs Datatron 205 computer equipment is housed in a new building on refinery grounds. Demonstrations of the electronic machine's ability to perform complex calculations in split seconds were given for employes and guests.

A $4-million natural-gasoline plant will go into operation this week in LaVerne field of Harper County, Oklahoma. It will process 100 million cubic feet of gas daily. Sun Oil, with a 30% interest, is operator for the 30-company plant. Gas from Michigan Wisconsin Pipe Line Co. will be processed and the dry gas will be returned to the Milwaukee-Detroit

Gas Changes Asked

. . . in Oklahoma in move to cut down on inequities.

OKLAHOMA wants to tighten up its control over gas production in the state.

The Corporation Commission on July 28 will hear an application by Massena B. Murray, state conservation director, asking that all gas-producing fields be classified.

Some gas fields were classified in a May 26 order. Murray wants now to change classifications in about 50 fields. And he says it will be necessary to restrict gas production during August and September to protect correlative rights and conserve gas, both as a resource and as energy for oil production.

Murray said the commission now believes it imperative to group the pools, classified and unclassified, as to method used in allocating production, testing, type of reservoir, and as to type of production—dry gas, oil and gas, or gas and condensate.

He recommended all gas pools be placed under the following classifications:

. . . **Dry gas fields:** Whether gas is allocated by nominations, by actual production, or are unallocated, or whether producers are permitted to produce 25% of open-flow test, are given a flat per-well allowable, or have a flat allowable based on plant or pipeline capacity.

. . . **Combination pools:** Whether the allowable is set by a volumetric formula, or there is a flat per-well allowable, or there is attributable acreage augmentation.

Changes are necessary, Murray said, to insure ratable taking and to remedy possible inequities in production of gas and oil.

Aramco Loses in Court

NEW YORK Supreme Court Justice Henry Epstein last week ruled that Arabian American Oil Co. may not inquire into the religious beliefs of prospective employes.

Aramco had been exempted from a New York law barrring such questions because its principal operations are in the Middle East, where the Moslem population has an intense hatred of Israel, and of Jews. Saudi Arabia has opposed sending Jews to work for American interests in that country.

Epstein said if he upheld the state agency which exempted Aramco from the law it would "undermine the very foundation" of American liberty.

Conoco Eyes Intrastate Gas

CONTINENTAL Oil Co. hopes to develop new intrastate gas markets.

Conoco has set up a new department to operate the company's present intrastate gas transmission systems and to "seek opportunities for expansion and development of additional intrastate systems."

E. W. Webb, senior vice president for Conoco, said the new department also will buy and sell natural-gas liquids and develop new markets for them.

J. W. Ferguson, Houston, former director of natural gasoline and gas operations, was named general manager of the department. Also transferred to the department was A. D. Maxwell, former manager of liquid petroleum gas sales, marketing department.

Oil Fees Boosted

. . . in Louisiana by law passed by the legislature.

LOUISIANA oil producers are paying higher fees under a law enacted in June by the legislature.

The law increases drilling permit fees from $50 to $100 and creates a new set of fees to defray the cost of public hearings held by the Louisiana Conservation Commission.

Revised conservation regulations make a drilling fee permit valid for 90 days, but a 90-day extension can be obtained by payment of a $25 extension fee. If the well is not drilled in 180 days, another $100 permit would be required.

Fees related to commission hearings are:

. . . **$100 for each** application for a public hearing on production rules and regulations. Each hearing would be limited to one sand.

. . . **$25 for altering** a drilling permit, except for unit well nomenclature.

. . . **$25 for each application** for a dual or multiple well completion.

. . . **$25 for each application** to commingle production from various leases.

. . . **$25 for handling** and processing applications for lease automatic custody transfer of oil.

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trunk line. The plant, built by J. F. Pritchard Co., will produce 117,000 gal. of liquids daily.

A polypropylene film plant—with a capacity of 10 million pounds annually—will be built by AviSun Corp. on a 214-acre site near New Castle, Del. The plant will be completed this fall. AviSun was formed earlier this year by American Viscose and Sun Oil.

An $8-million urea plant is being built by Sun Oil Co.-Olin Mathieson Chemical Corp. at Claymont, Del. The plant, adjacent to Sun's Marcus Hook, Pa., refinery, will be on stream in 1960. It will produce about 73,000 tons of urea and 10,000,000 cu. ft. of hydrogen annually for Sun's refinery.

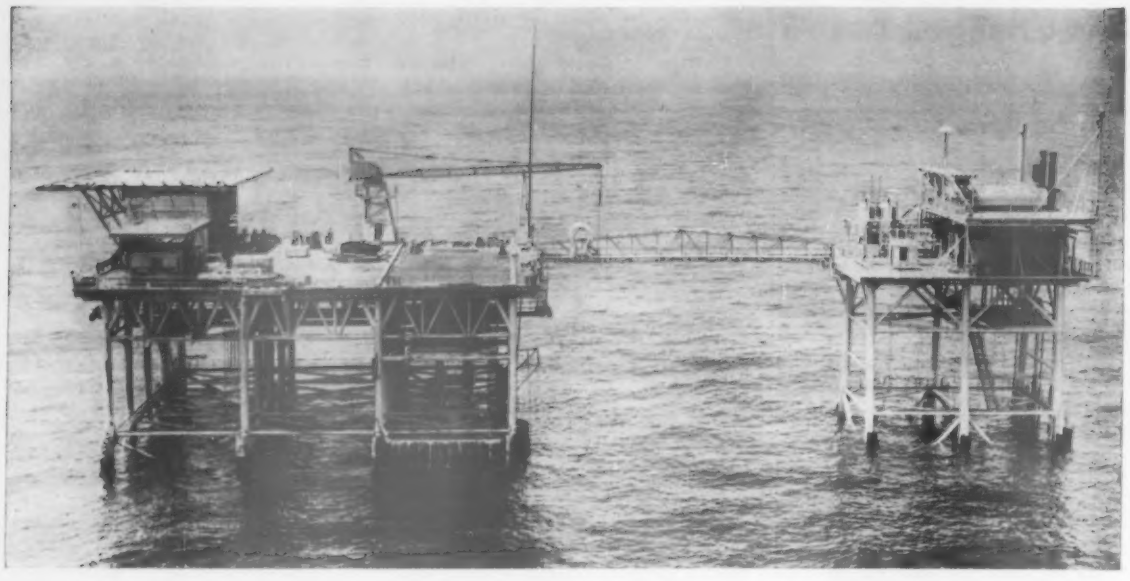
A $3.5-million engineering and construction contract has been awarded Fluor Corp. of Canada by Carstairs Operators' Committee of Calgary, Alta., to build a gas-processing plant near Carstairs. The plant will process 66 million cubic feet of gas daily.

Diamond Alkali Co.'s 20% chlorine-caustic soda plant expansion at Deer Park, Tex., has been put into operation. The new facility—with initial operating rate of 50% of capacity—boosts total daily capacity of the Deer Park works to 750 tons of chlorine, 825 tons of caustic soda, and 7,500,000 cu. ft. of high-purity hydrogen.

Also for Refiners . . .

IN THE NEWS: Texas orders another 9-day producing month for August. Buyers say both crude and products markets will benefit (p. 42) . . . Three unions competing to represent workers at Humble's Baytown refinery (p. 44) . . . Skid-mounted filling stations are the latest marketing innovation in Texas (p. 46) . . . House committee to consider gasoline-tax hike this week (p. 50).

PLUS THESE TECHNICAL REPORTS: Contract maintenance can cut costs (p. 68) . . . Hydrogen sulfide to sulfur by direct oxidation (p. 76) . . . Continuous R.v.p. analyzer cuts gasoline blending time in half (p. 82).



Shell Installs Big Gas-Handling Platform in Gulf

SHELL Oil Co. has installed in offshore Louisiana a gas-handling platform that will run 35 million cubic feet of gas daily from 15 wells.

The huge platform weighs 700 tons and is installed in 56 ft. of water in West Cameron Block 192, 45 miles southeast of Cameron, La.

A 100-ft. walkway connects the platform with the drilling platform. Expansion loops in the gas piping at the left end of the bridge are designed to compensate for movement between platforms during storms.

Higgins Shipyard, New Orleans, built the gas-handling platform. Gas piped from the platform is sold to Tennessee Gas Transmission Co.

PIPELINE BRIEFS . . .

First gas is being pumped into a new $25,000,000 underground storage in the Leidy and Tamarack fields of north-central Pennsylvania at the rate of 120,000 M.c.f. daily. New York State Natural Gas Corp. is 50% owner and operator and Transcontinental Gas Pipeline Corp. and Texas Eastern Transmission Corp. each has a 25% interest. Capacity of the 15,000 acres in the two fields will exceed 105,000,000 M.c.f. The gas will serve New York, Pennsylvania and New Jersey consumers. Transcontinental is furnishing gas for the initial operations.

Contract for construction of 58 miles of 26 and 30-in. pipeline in Kentucky and West Virginia has been let by Tennessee Gas Transmission. The line will be laid by H. C. Price Co., Bartlesville, Okla.

Contract for a 44-mile 8-in. oil pipeline in Eddy and Lea counties, New Mexico, has been awarded H. B. Zachry Co. by Service Pipe Line. Construction, to start this week, is to be completed in 30 days. The line will connect the Empire-Abo field with Service's Caprock, N. M., station. A 100-hp. electric pump station with a 10,000-bbl. tank will be built in the field to handle crude oil from 17 leases. H. B. Zachry Co. also will construct a 3.7-mile 4 and 6-in. gathering system in the Empire-Abo field.

Station 40, Southern California Gas Co.'s pioneer natural-gas pumping station, is to be torn down after pumping gas over the Tehachapi Mountains for 45 years. A new Station 40, with four modern gas engine compressors, has been put into operation.

A 75-mile 18-in. line will be laid by East Ohio Gas Co. in Harrison, Mahoming, Columbiana, Carroll, and Belmont counties, Ohio. Contract has been awarded to Sharman, Allen, Gay & Taylor, Houston. Construction is scheduled to start this week.

The FPC will hear oral argument July 28 on a $55,000,000 expansion program proposed by Southern Natural Gas. The project was approved by an FPC examiner in June. Proposed facilities would increase the gas-transmission capacity of the Southern Natural pipeline system from about 990,000,000 cu. ft. daily to 1,365,000,000.

Also for Pipeliners . . .

IN THE NEWS: Oil generally can last 90 days without feeling pinch of steel strike. New projects, especially pipelines, must await end of strike, however (p. 39) . . . Texas Eastern cuts tariff for propane on the Little Big Inch (p. 50) . . . Oklahoma may tighten up controls over gas production (p. 63) . . . Shell installs a big gas-handling platform in the gulf (p. 54).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are carried in pipeline briefs.

PLUS THESE TECHNICAL REPORTS: Automation in cathodic protection (p. 72) . . . Economics favors cathodic protection of gas lines (p. 107).

Special report to Caterpillar D8 Tractor owners:

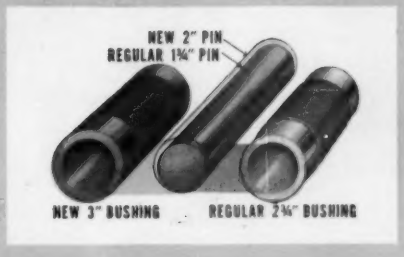
CAT CATERPILLAR

Parts you can trust
Dependable round-the-clock service

NEW TRACK COMPONENTS AVAILABLE FOR MOST D8 TRACTORS... GIVE UP TO 44% LONGER LIFE

Caterpillar's continuous research and testing pay off for you with the development of superior D8 track components. The next time you replace track parts, specify these new components. They last longer and require less maintenance. Here's what's available for 2U, 13A, 14A and 15A tractors:

30% STRONGER PINS AND BUSHINGS have more wear area to extend life. The big track pins are ¼" larger in diameter and heat-treated deep to resist wear . . . pins will not bend and cause uneven wear. The large contact areas of the bushings are hardened deep, both inside and out. Under field conditions these bushings have lasted up to 44% longer than regular bushings.



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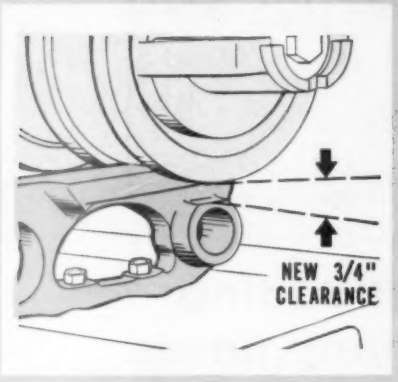
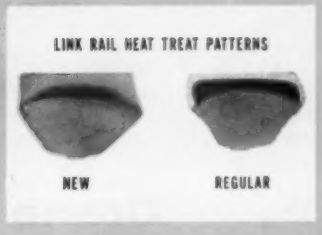


STRONGER, LONGER, HIGHER TRACK LINKS are 3 lb. heavier, 1" longer and ¼" higher. New length means fewer track sections are required. Increased height gives up to ¼" more *link pin boss-roller flange* clearance. Improved steel used in these links permits 80% deeper rail hardening and greater strength —pins and bushings stay tight *in the links* even under the roughest application.



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NEW TRACK SHOE GROUSERS ARE 20% THICKER at the tip and are hardened much deeper than on regular shoes. The new shoe as a whole is bigger and heavier to resist bending, impact and wear. Track hardware used with the new track components is stronger—bolt diameter increased from ¾" to ⅞".

• • •

NEW DESIGN BORALLOY SPROCKET REPLACEMENT RIMS are available to accommodate the increased pitch of the longer links and bigger track bushings. Teeth are precision-machined to provide exact fit with track bushings—a major contribution to longer bushing life.

SEE YOUR CATERPILLAR DEALER for more information on extending your D8 track life. He has parts you can trust and round-the-clock service. See him today.

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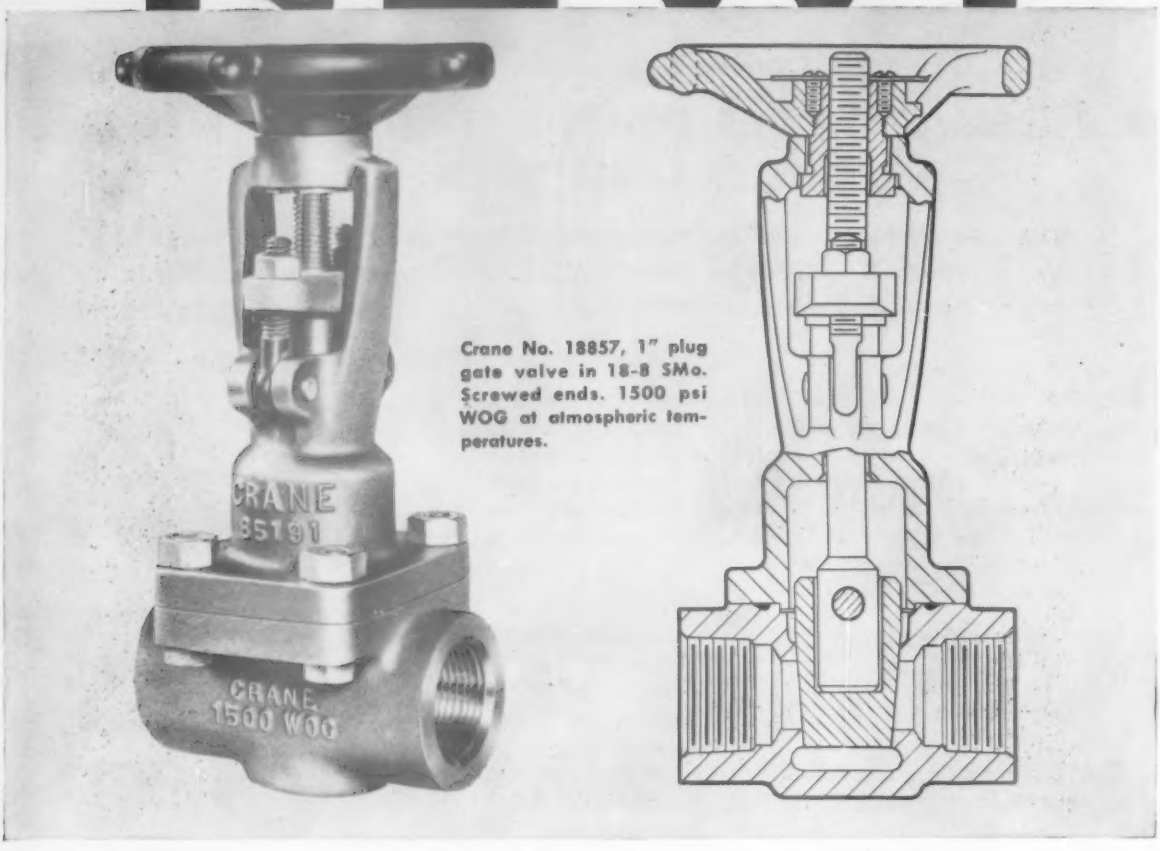

Crane No. 18857, 1" plug gate valve in 18-8 SMo. Screwed ends. 1500 psi WOG at atmospheric temperatures.

Crane valve for water flooding will outlast any other—many times

It's a rugged, plug gate valve made of corrosion-resistant Type 316 stainless steel. You can use it on *all* water flooding installations at pressures up to 1500 psi. Tests show this new Crane valve will give satisfactory service—not two to eight months as with ordinary valves, but *for the entire life of a flood under the worst corrosive-erosive conditions!*

Shutdowns of injection wells for valve repairs can now be all but eliminated. This means uninterrupted flow from production wells . . . more oil recovered . . . big savings in time, manpower and money.

Features

1. Made in 18-8 SMo—resists erosion and severest corrosive flow and atmospheric conditions.
2. Plug gate design—ideal for close throttling or tight shutoff service. Eliminates destructive jet action of water—common with needle or plug disc globe valves.
3. Reduced seat opening, fine stem threads, big handwheel permit sensitive flow control.
4. Close fit between stem and yoke sleeve. Vibration can't change throttle adjustment.
5. Non-turning stem and disc prevent galling between disc and body seat.
6. Two-piece, ball-type packing gland can't bind on stem.

For complete details, ask your Crane Representative for Circular AD-2377, or write to address below—

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PIPE • PLUMBING • HEATING • AIR CONDITIONING

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Arctic Service Station Has Long Day

NO SERVICE station in the world has a greater opportunity for daytime business than a new Norske Esso center at Hammerfest, Norway.

The reason is the sun does not set from May 13 to July 29 each year. The station is 600 miles north of the Arctic Circle, and is the northernmost in the world. Conversely, business is mighty slow in the long night from November 18 to January 23, when there is no sun at all. The city has long been an important bunkering station for fishing fleets.

Houston Looks Ahead to 2059

. . . with unusual 100th birthday party for oil. Civic and industry leaders join in presenting a 2-day symposium.

HOUSTON will celebrate the 100th birthday of the oil industry next month by looking forward to the next 100 years.

Civic and industry leaders have joined in promoting a 2-day symposium at the University of Houston that puts the spotlight on the social, economic, and moral impact of the industry on society.

A blue-ribbon panel of experts, many of whom have no connection with oil directly, will be brought to Houston August 26-27 for the event.

Dr. Richard G. Folsom, president of Rensselaer Polytechnic Institute, Troy, N. Y., will speak on the symposium's theme, "The Next 100 Years." He will discuss the changes expected in the industry and in society in general from 1959 to 2059.

Rev. Laurence J. McGinley, president of Fordham University, will speak on the "Moral Commitment to the Coming Generations."

Dr. Karl Sax, of Harvard University, will discuss population changes and the demands of the world's peoples in the next century.

Leonard J. Saccio, deputy director of the International Cooperation Administration, will speak on "The Emerging Nations."

The program also will contain several panel discussions on energy sources for the next century, population problems, the challenge to management, and the coming generations.

The symposium, which replaces Oil Progress Week in Houston this year, is sponsored jointly by the Oil Information Committee, the Houston Chamber of Commerce, and the University of Houston. Chancellor A. D. Bruce of the University of Houston is chairman of the executive committee for the program.

Louisiana Allowable Set

THE DEPTH-BRACKET allowable for Louisiana will be held in August at the same level maintained for the past year, and total production will be increased only for new wells. The July allowable is 901,644 bbl. daily, and the increase for August will amount to some 10,000 bbl. daily.

Conservation Commissioner Ashton J. Mouton, Jr., also announced last week that Louisiana, starting in September, will make allowable orders for 2-month periods, rather than for 1 month.

The September-October allowable will be set after a hearing August 11 at Lafayette. Crude purchasers will make buying estimates for a 2-month period at the hearing.

Except for increases for new production, Louisiana's allowable has remained at the same depth-bracket figure for 12 straight months. The figure is 34% of the flow rates of March, 1953.

Competition Added

. . . to petroleum inspection business by court decree.

THE petroleum-inspection business may become highly competitive as result of a recent consent decree entered in U. S. District Court for the southern district of New York.

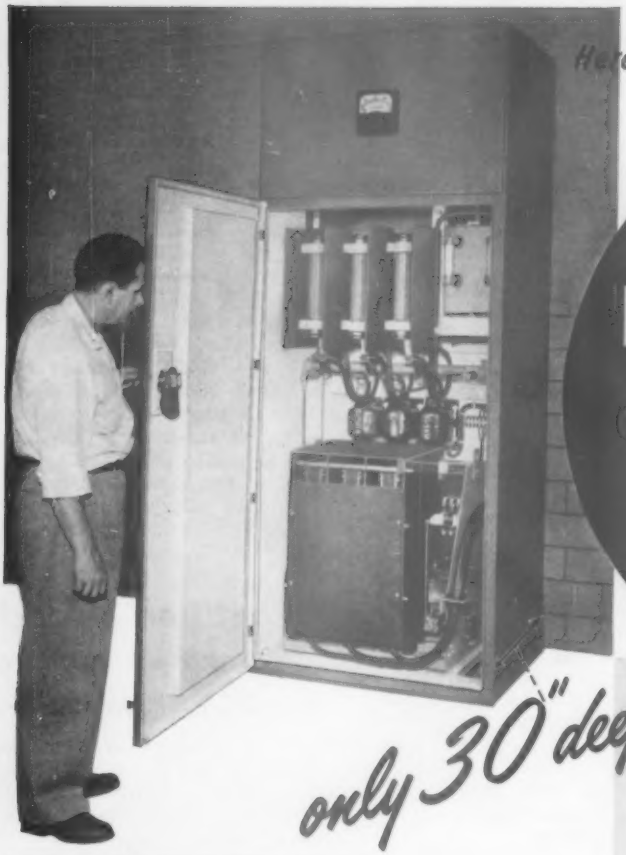
U. S. Atty Gen. William P. Rogers announced terms of the judgment terminating a civil antitrust suit filed June 30. The suit charged restraints of trade in the petroleum-testing and inspection business in violation of the Sherman Act.

Named as defendants were New York Produce Exchange, New York; E. W. Saybolt & Co., Elizabeth, N. J.; Joseph H. McCabe, a partner in E. W. Saybolt & Co.; and Randolph W. Sluter, doing business as Chas. Martin & Co.

According to the Government's complaint, New York Produce Exchange, which issues licenses qualifying persons as petroleum inspectors, accounted for all issued petroleum inspectors' licenses in the United States. The exchange and individual defendants were accused of adopting a policy of refusing petroleum inspectors' licenses to persons other than those associated with the individual defendants and their respective companies.

The judgment, entered upon consent of the parties to the suit, requires the exchange to adopt and publish uniform, reasonable, and nondiscriminatory standards for the granting of licenses. It requires the exchange to issue a license to any applicant who qualifies under the new standards.

Here is **DESIGN LEADERSHIP...** *in Action!*



3-way Padlock Protection WITH EC&M Air-Break High Voltage (2200-4800 VOLTS) Starters

only 30" deep!

Accessible from Front...

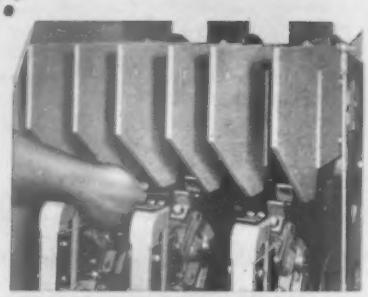
(Solid back) • Starters may be mounted against wall or in double row, back to back

EC&M's door-and-disconnect interlocking system gives you 3-way padlocked safety. The gang-operated Disconnect Switch may be padlocked (1) in the "ON" position or (2) in the "OFF" position—both with the starter door closed. (3) The door opens only by backing out captive thumb screws after the contactor and disconnect are open. For COMPLETE SAFETY—Disconnect Switch blades engage grounding clips in the open position.

EC&M's simple interference interlock permits manual operation of the contactor to check contact alignment, shaft rotation, and electrical interlock engagement. No roll-out is needed for any maintenance—contacts, operating coil, and control contacts are fully accessible within the enclosure.

EC&M starters are furnished with a control transformer. Since the bus is located in an isolated upper compartment, only one feeder is required for a group of starters.

Write for **BULLETIN 8130**



NO DRAW-OUT NEEDED • Arc shields slide out horizontally, making front and rear contact-tips removable with standard wrench.

3 Interrupting Ratings for Squirrel Cage, Synchronous and Wound-rotor Motors

1. **CLASS E 1** • 50,000 KVA (symmetrical) based on certified tests.
2. **CLASS E 2** • With current limiting fuses and high interrupting capacity contactor. At 2300 volts: 150,000 KVA, 3 phase; 60,000 RMS amperes asymmetrical. At 4,800 volts: 250,000 KVA, 3 phase; 60,000 RMS amperes asymmetrical.
3. **VALIMITOR®** • May be used on a bus of unlimited short circuit capacity, through the use of a contactor with an interrupting rating of 50,000 KVA, and reactors which limit any fault current to a maximum of 25,000 KVA.

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Karachi Wildcat Nearing Half-Way Mark

LIGHTS from Karachi's fashionable residential area light up the night sky beyond the hill top where Pakistan Petroleum Ltd. and Tidewater Oil Co. are drilling a deep test.

The partners hope Karachi 2 turns the West Pakistan capital into another Oklahoma City or Long Beach. The test is less than 100 yards from No. 1, which Pakistan Petroleum drilled alone and gave up at 9,958 ft. because of technical difficulties.

Karachi 2 is drilling ahead at 6,500 ft. after making steady progress through very hard formation. Projected depth is 15,000 ft.

Lines to Link Wells

. . . off California coast to tankage at Summerland.

CONSTRUCTION has started on facilities to handle production from wells now being drilled by Standard Oil Co. of California, Western Operations, Inc., on a 5,500-acre offshore lease from Summerland, Calif.

The facilities will include onshore tankage and related equipment and four pipelines.

Three of the lines will connect the platform with the onshore tanks. The platform is 2.2 miles offshore in 100 ft. of water. The fourth will be a 20-in. line from the tanks to an existing offshore tanker mooring.

The three lines from the platform will be laid in one ditch and the 20-in. line in an adjoining ditch. During construction two elevated cableways will extend from shore to a tower and anchor about 600 ft. offshore. These cableways will be used to support trolleys carrying tools back and forth along the ditches.

The $2-million project will take about 4 months to complete. Morrison-Knudsen Co. will build the pipelines.

Standard-Western, as operator for itself and Humble Oil & Refining Co., has completed four wells from the platform. Three are producers and the fourth is a dry hole. The two companies obtained the lease several years ago for a $7,250,000 bonus.

INDUSTRY BRIEFS . . .

Operators in East Seminole pool have been authorized by the Oklahoma Corporation Commission to conduct a unitized water-flood operation in the Senora sand zone. W. E. Stiles Engineering, Inc., of Tulsa, handled unitization of the 750-acre project and will operate the water flood.

Occidental Petroleum Corp., Los Angeles, reportedly is negotiating to purchase Gene Reid Drilling Co. of Bakersfield. Plans call for the Reid firm to become a subsidiary of Occidental. Reid conducts contract drilling and in addition has about 250-bbl. daily production from 55 wells.

Humble will combine its Port Sulphur and Paradis districts in Louisiana into a single district with headquarters at Harvey. The change will take place early in 1960. The Harvey office will have 67 employes. A large number of field employes will remain at Port Sulphur and Paradis.

Commonwealth Petroleums, Ltd., has acquired a financial interest in General Petroleum Drilling Company, Ltd. Commonwealth, a holding company whose subsidiary, Commonwealth Drilling Co., Ltd., is Canada's largest oil-field drilling firm, obtains a financial interest in an additional 20 drilling rigs owned by General Petroleum.

Merger of Stauffer Chemical Co. and Victor Chemical Works has been approved by directors, subject to stockholder approval. Stauffer specializes in industrial and agricultural chemicals and Victor in phosphates and allied products. Stauffer plants are in Louisville, LeMoyne, Ala., Dominguez, Calif.; Baton Rouge, La.; Baytown and Houston, Tex., and Hammond, Ind. Victor plants are in Nashville and Mount Pleasant, Tenn., Silver Bow, Mont.; Southgate and Richmond, Calif.; Chicago Heights, Ill.; Morrisville, Pa., and Victor, Fla. Sales of the two firms are expected to reach $225 million in 1959. Victor would operate as a division of Stauffer.

More than 1 billion pounds of lubricants were produced in the U. S. and Canada in 1958, a survey by the National Lubricating Grease Institute reveals. Production was down slightly from 1957, when the first survey was made. However, fluid gear lubricants showed an increase in 1958.

Throughput of British American Oil's Pincher Creek gas-processing and sulfur plant will be stepped up this fall from 120,000,000 to 180,000,000 cu. ft. of raw gas daily. Expansion of B-A's Nevis gas plant will increase the daily raw gas capacity from 15,000,000 to 35,000,000 cu. ft.

PUSH-BUTTON traffic lights (circle) keep two cars from crossing one-lane causeway at same time.

Drilling on Island Calls for Innovations

CARRYING on a drilling operation from a 1-acre, man-made island presents some unique problems—but Richfield Oil Corp. is finding ways to solve them.

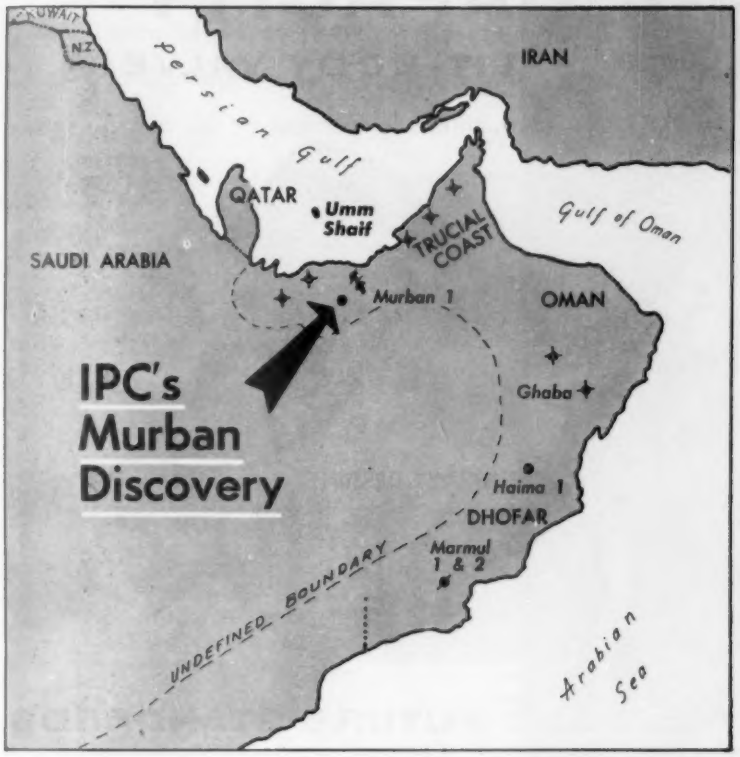
Two situations confronting the company in operations on its Rincon drilling island ½ mile out in the Pacific Ocean were traffic on the one-lane causeway and possible pollution.

Richfield handled the traffic problem by installing push-button controlled traffic lights at each end of the ½-mile causeway. They keep two cars from starting across at the same time.

To prevent pollution, the company has containers underneath the rig floor to catch cuttings from the mud screen. The containers are moved by a fork-lift truck and dumped into a waste mud pit. Slots on the sides of the containers make it easy for them to be lifted.

Cuttings, as well as sand removed by two mud centrifuges, then are hauled to shore by vacuum trucks. Sumps are provided for collecting waste and wash-down water from the rig floor.

DUMPING cuttings into waste mud pit prevents pollution at island.



IPC Well Looks Good

. . . after first test, but it is in an area of southern Arabia that has made a big splash and then faded fast.

A COMMERCIAL discovery may be in the making in the most frustrating exploration area in the Middle East.

The find was made in Murban 2 by an affiliate of Iraq Petroleum Co. in Abu Dhabi, one of the Trucial Coast shaikhdoms that ring the southern coast of the Arabian Peninsula. The discovery could become the second for the shaikhdom. Evaluation drilling is now in progress in Umm Shaif field, discovered far out in the Persian Gulf by a British-French company.

Murban 2 is located comparatively close to the Persian Gulf, about 150 miles southeast of Qatar Peninsula. It is 4½ miles southwest of Murban 1. Initial reports are that the well flowed at the rate of 2,000 bbl. daily on a short test from two zones. Depth was not immediately learned.

The apparent Murban find together with the Umm Shaif find may mean that southern Arabia is beginning to crack open as a possible new oil province. But other apparent discoveries have fizzled in the region, and wildcatting for the most part has been expensive, deep, and dry.

Two IPC companies, Petroleum Development (Trucial Coast), Ltd., and Petroleum Development (Oman), Ltd., have drilled seven dry holes ranging in depth from 12,235 to 13,001 ft. The latest abandonment was at Ghaba, a location in Oman inland from the Arabian Sea. The hole was taken to 12,661 ft. this year before the rig was moved off. The new location is at Haima to the southeast, where a wildcat is now getting under way.

Murban 1 looked like a possible discovery 6 years ago. It came in with a flow of 1,500 bbl. daily. But there was mechanical trouble, and the well failed to yield oil when retested. It was finally abandoned at 12,588 ft.

Cities Service . . . Promising wildcats also have failed to live up to hopes in a Dhofar concession held by Cities Service. Marmul 1 and 2 at first looked good, but production quickly declined to an uneconomic level.

Cities Service has drilled 11 wells on the concession, including the first 2 Marmul wells and 9 dry holes. The latest test was M-10, located about 70 miles west of Marmul 1. It was abandoned at 11,240 ft. No wells are drilling at present, but seismic work is in progress.

Das Island . . . Abu Dhabi Marine Areas, Ltd., owned two-thirds by British Petroleum and one-third by CFP, continues to evaluate Umm Shaif field, 20 miles north of Das Island in the Persian Gulf.

The first well tested about 2,400 bbl. daily of 40°-gravity crude from the Lower Cretaceous Shuaiba limestone. Total depth of the hole is 8,755 ft. Umm Shaif 2 is promising.

Sui Plant Talked

. . . to turn out carbon black from West Pakistan gas.

ONE OF the few carbon-black plants to be built outside the U. S. may be located in West Pakistan.

Preliminary talks on the possibility of setting up the plant have been held in Paris by Constock International Methane, Ltd., and Burmah Oil Co. The carbon black would be made from Sui gas, a dry gas produced in Central West Pakistan by Pakistan Petroleum, Ltd., a Burmah Oil subsidiary.

The product would be marketed in Japan, where there is a big ready-made demand, as well as in other Asian countries. Almost all of the 450,000 tons of carbon black produced yearly comes from the U. S.

The carbon-black project was one of the topics of the meeting called because of encouraging preliminary studies of the Far East as a market for liquefied methane. As a result of preliminary studies in Japan, a detailed survey is now under way on potential markets.

The Pakistan Government is working hard to bring the project to the country. The minister of finance has made a trip to Washington, where he held talks with Adm. A. W. Radford, adviser to the joint Continental Oil Co.-Union Stock Yard venture. Upon his return to Pakistan, the minister said negotiations were "moving forward favorably."

MORE CAPACITY

TWO NEW SPLIT-BODY VALVES

"S" DESIGN

"Y" DESIGN

BEST BY PRESENT AND FUTURE STANDARDS!

This new Hammel-Dahl "S" model starts out traditionally...split-body, I.S.A. standards, slip-on flanges and retained, invertible seat ring...but that's where similarity with other "S" types ends!

Greatest possible flow capacity combines with extended-stem guiding and travel length to give optimum flow control for the most demanding modern process.

Nominal Sizes: ½" to 10"

Body Configurations: "S" and "SL" (90° angle)

Body Ratings: 600 lb. ASA to 2500 lb. ASA

Connections: 150 to 2500 lb. ASA Flanged. (Removable or Integral Flanges.) Screwed or welding ends.

Face-to-Face: I.S.A. Std. Also available in non-standard dimensions.

Materials: Cast Steel, Stainless Steel, Cast Iron, Nodular Iron, or any castable alloy.

YOUR CHOICE OF ACTUATORS: The Positioning Piston (shown) is one of more than 15 easily interchangeable actuator designs. Modes of actuation include:

- Pneumatic (Piston, Diaphragm, Isoforce)
- Electro-Hydraulic (Hydramotor)
- Electric (Tork-Master) or Manual.

The advanced new "Y" design incorporates I.S.A. standard face-to-face* dimensions, "S" valve travels and actuators. But it sets **new standards** for CV per nominal pipe size and for mechanical characteristics of fluid control. Straight-through flow eliminates hold-up and Cv's are **phenomenal** in every size.

Nominal Sizes: ½" to 10"

Body Configurations: "Y" and "YL" (45° angle)

Body Rating: 600 lb. ASA to 2500 lb. ASA

Connections: 150 to 2500 lb. ASA Flanged (Integral Flanges.) Screwed or welding ends.

***Face-to-Face:** I.S.A. Std. thru 4" size. Also available in non-standard dimensions.

Materials: Cast Steel, Stainless Steel, Cast Iron, Nodular Iron, or any castable alloy.

You can reduce costs with one of these new Split-Body designs. It's sure worth checking with the Hammel-Dahl Representative in your area. Call today.

Manufacturers of Control Valves and Allied Equipment

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Venezuela May Prorate Oil

. . . in an effort to stabilize the country's production. Railroad Commission engineer is given leave to help new study group set by Ministry of Mines and Hydrocarbons.

MARKET proration may be Venezuela's next move.

Newly elected President Romulo Betancourt has long been disturbed about Venezuela's oil future. He's afraid Venezuela will deplete its national wealth too quickly if production keeps going up. The world-wide surplus of oil and the resulting softness of prices bothers him most of all.

With efforts to get Arab oil-producing countries to agree to curb output less than a howling success, Venezuela has begun to move on her own. Two months ago the government set up a new commission to study proration. Venezuela asked for, and got, assistance from the Texas Railroad Commission. Last week, Mac L. Coker, a Railroad Commission engineer, was given a leave of absence to work in Venezuela.

Coker wasn't sure last week what he'll be doing in Venezuela, but he's going to work for the next 6 months with Dr. Eduardo Acosta Hermoso, director of the technical office of hydrocarbons. It is widely assumed that his work will be in connection with the new commission for "conservation and marketing of hydrocarbons."

When the new group was set up within the Ministry of Mines and Hydrocarbons in April, Dr. Juan Pablo Perez Alfonzo compared it to the Texas Railroad Commission and Canada's proration groups. He said its first job would be a detailed study of production and sales programs of oil companies.

"Venezuela needs to know a little more about what happens to its oil," he said at that time.

Alfonzo's theory . . . As an old colleague of Betancourt's, the new minister of mines shares the president's theories on oil policy.

He wants to conserve Venezuela's oil. He points to the U. S. as an example of a country that is using her oil faster than she is finding new supplies to replace it.

The new minister insists that Venezuela is not interested in maintaining its present share of the world oil market as that market continues to grow. Alfonzo is much more interested in stable Venezuelan production at higher prices per barrel and more revenue to the government.

Mac L. Coker
. . . heading for Venezuela

Two months ago Perez Alfonzo headed a 21-member Venezuelan delegation to the Arab Oil Congress in Cairo to try and sell his theory to the Arab oil producing countries. He got a polite reception but his offer of a gentleman's agreement between all the Arab oil countries and Venezuela was received with less than wild enthusiasm.

The Arab governments are all struggling to get a bigger and bigger share of the world's oil market, increasing production from their much more prolific fields all the time.

The hold-down-production aim of Venezeula's 4-month-old government is a real paradox in view of the country's financial ills.

Like the Arab countries that are straining every muscle to boost production, Venezuela's economy is closely tied to oil. Oil will be the backbone of Venezuela's economy for a good many years, but the government doesn't want it this way to such an extent.

In spite of its oil revenues, Venezuela last year wound up with a deficit of almost $530,000,000 with a budget of $1,745,000,000. The 1959-60 budget, now being debated in Caracas, will be well over $1.8 billion.

Betancourt's government blames the corrupt and dictatorial regime of Gen. Marcos Perez Jiminez for the country's present financial woes. Government officials say they are still saddled with the grandiose and costly schemes started by the dictator's regime. They don't believe increased oil production—even to get them back into the black—is Venezuela's answer.

India's Hopes Up

. . . after well hits gas at 300 ft. in Bombay region.

INDIA has more exploration encouragement in the Bombay region along its west coast.

A well at Mahuvej blew out after hitting a shallow gas horizon at 300 ft. A 12-ft. crater was formed, and after the gas flow shut in with cement, the well blew out again the next day. The location is near Surat, a city on the Arabian Sea, north of Bombay.

The Indian Government is viewing the strike with cautious optimism. The region is an area where the government is undertaking exploration on its own, with the aid of Romanian equipment and crews. Concessions are held in eastern and northeastern India by Standard-Vacuum and a Burmah Oil Co. subsidiary.

At least two other wells in the Bombay area have been encouraging. A wildcat near Cambay had a small-scale blowout below 5,000 ft., and a second test drilling on the structure has encountered oil and gas with some pressure. Another well, at Vadser, kicked up a 60-ft. gusher for a short time when it hit a shallow pocket at 600 ft.

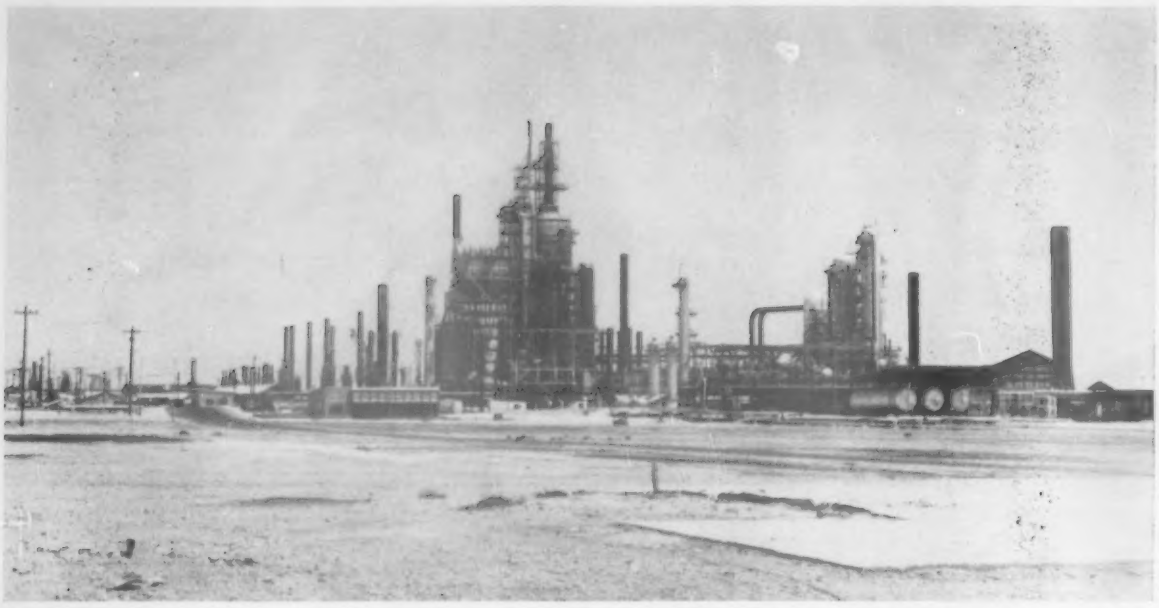
Two more Romanian rigs have arrived in India, and these are expected to speed work in the Bombay area.

Ceylon May Get Refinery

AFTER years of negotiation, the Ceylon Government and a group of four oil companies appear to be coming to an agreement on a refinery project.

The government says that negotiations are in the final stages, and that permission soon will be granted for a $30-million plant to be built at Trincomalee. The location is on the island's east coast, 215 miles from Colombo, where there are storage facilities at a former British naval base nearby.

Participants in the program will be Stanvac, Caltex, British Petroleum, and Royal Dutch-Shell. The government will have a 20% investment in the operating company.



BAPCO'S refinery started as a 10,000-bbl. plant, but now processes about 190,000 bbl. daily from fields in Bahrain and Saudi Arabia.

Bahrain: Granddaddy of American-Found

- Crude-oil production has hit a peak of about 45,000 bbl. daily, but this little island is a booming refining center and big gas reserves.

Paul E. Swain
International Editor

BAHRAIN, where American oil in the Middle East was born, has reached middle age.

The little island is surrounded by lusty, still growing, and youthful oil industries in other Arab countries, but Bahrain has settled down to the twilight of its oil life.

There is little likelihood that the field where the first U. S. oil discovery was made will ever produce more than its current 45,000 bbl. daily.

In nearly every other oil producing country in the Middle East there is still exploration and drilling. Not in Bahrain. Unless subsea oil is found at some time in the future under the waters that separate Bahrain from Saudi Arabia, the hunt for Bahrain oil is virtually finished.

In spite of this producing plateau, Bahrain's oil output has taken a startling jump in the past 2 years. In 1958 the daily average soared to 40,748 bbl. daily, a jump of 27% after years of a steady 30,000 bbl. or so.

But even this healthy increase can't be attributed to new drilling or new discoveries. The added oil output has come entirely from new and improved producing practices. Bahrain Petroleum Co. (Caltex) is hard at work recovering oil it had left behind in the field.

The geology . . . The structure which yielded Bahrain's first oil May 31, 1932, spurring interest in the whole Arabian peninsula, is a real textbook picture.

The structure is apparent from the surface outcrops. It's a simple fold with the major axis north-south in the very center of the island.

The center of the structure is marked by Jebel Dukhan, a butte outcrop that commands the whole area. The field is surrounded by a high rimrock which marks the dip-slope of the island seaward on all sides.

The subsurface structure can be mapped almost perfectly from the exposed outcroppings along this rimrock. The 147-well field produces from two Cretaceous limestone pays and a third Jurassic limestone, which also produces high-pressure gas used for injection in the field.

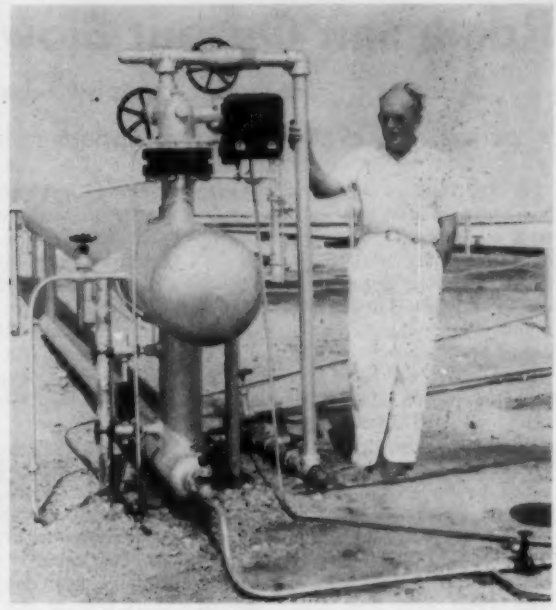
The Cretaceous sections are between 1,800 and 2,300 ft. and the Jurassic is found at about 4,300 ft.

Gas injection pioneer . . . Bapco has been injecting gas into the shallower of these pay formations since 1938 when reservoir pressures began to drop alarmingly below the original 1,200 psi. The crude is undersaturated, with a bubble point about 300 psi. and moved by an active water drive.

When the company experienced that initial drop in reservoir pressure, gas injection was started to create a gas cap in the field. Today the gas is injected at the rate of 32,000 M.c.f. daily. The injection rate is controlled to balance the oil production and water invasion, keeping the reservoir pressure at the original 1,200 psi.

Bahrain's field is fully developed. All past efforts to find deeper oil have proved fruitless. Three deep tests have been drilled across the structure since 1937, but all have found only gas in deeper horizons.

THE JOURNAL'S international editor, Paul E. Swain, checks a plaque at Bahrain's discovery well.



BAPCO'S production manager, Charley Davis, looks over a wellhead equipped with a locally developed water knockout.

Oil in the Middle East

The latest deep test, Buri, went down to the Arab zones at about 7,000 ft. All were dry.

If Bapco can ever find a way to use the gas it has in those deeper formations, the company can tap a large reserve. Just how much there is of this 6,000 psi. pre-Permian gas found at from 10,300 to 11,000 ft. hasn't even been estimated.

"It's a helluva lot of gas; we know that," Charley Davis, Bapco manager of production, says.

The refinery . . . The real workhorse of Bahrain's oil is the big Bapco refinery.

Originally built in 1936 with a capacity of only 10,000 bbl. daily, the refinery has spread steadily with new additions. Last year it processed an average of 192,918 bbl. daily.

Capacity of the refinery long ago outstripped the island's oil output, but refinery feed stock is supplemented by Saudi Arabian crude supplied by a 17-mile underwater pipeline system from Damman to the island. The original line has been looped increasing its capacity to about 200,000 bbl. daily.

The big refinery serves a shipping terminal on Sitra island which lies just to the northwest of the main island of Bahrain. The terminal can accommodate six tankers at a time, shipping a full range of refined products.

Europe Is Having an Octane Race, Too

THE QUALITY of premium gasoline in Western Europe is not taking too much of a back seat to the U. S.

Regular grades have considerably lower octane numbers than the counterpart in the U. S., as might be expected from the large fleets of small cars. But the few cars which require octanes up in the 90's can find it without trouble anywhere in Europe.

A survey compiled by Associated Ethyl Co., London, shows that earlier this year gasoline of at least 90 Research octane could be purchased anywhere in Europe. This was the minimum.

The survey showed that on the whole, the average gain in octane in the past year was one number, both for premium and regular.

Europe's Octane Ratings Are Climbing

	Research Octane Numbers			
	PREMIUM		REGULAR	
	1958	1959	1958	1959
West Germany	94-97	95- 98	85-88	86-89
Switzerland	93-96	94- 99	83-89	85-89
Belgium	92-96	93- 97	84-87	84-88
Austria	92-94	92- 94	79-86	81-87
Finland	94-95	94- 95	85	79-87
Italy	96-99	98-100	84-86	84-86
Denmark	92-94	91- 94	83-85	82-86
Netherlands	91-93	90- 94	83-85	83-85
Sweden	93-94	93- 94	83-84	83-85
Great Britain	94-97	95- 98	79-83	80-85
France	90-91	90- 94	80-81	80-83
Norway	92-94	92- 94	79-82	79-83
Spain	88-91	90- 92	70-77	77-79
U. S. weighted average, June	**98.5**	**99.1**	**91.2**	**91.9**

Romanian Output Slows Down

. . . and halts great strides made by industry in a 5-year period. The 1960 targets now appear to be out of reach.

A PERIOD of sparkling advance has ended in Romania and the country's oil industry now appears to be almost standing still.

As the most important source of oil in Russia's satellite empire, Romania had doubled its production of crude and natural gas in the 5-year period ending in 1955.

Actual crude output in the final year was 10,575,000 tons, or about 212,000 bbl. daily.

On the strength of this showing, a healthy target of 270,000 bbl. daily was set for 1960. But in the years since then, progress has almost come to a standstill. Output of 227,000 bbl. daily last year was up only 1½%. The 1960 goal now looks out of reach.

The underlying reason for the slowdown has been a failure to develop new reserves. Most of the increases earlier in the decade were from discoveries in the Oltena area of western Romania. The region is now believed to be the major source of production, as old fields in the Ploesti area continue to decline.

No important new finds have been brought in for several years, which is making Communist leaders take a long look at proved and probable reserves. The country's 4,000 wells average slightly over 50 bbl. daily. But, as might be expected, large numbers of wells are marginal producers in old areas.

Natural-gas production is also expected to miss the 1960 target. Output is rising, but most of the gains are from fields that have been known for some time. These are being opened as pipelines are built to Bucharest and other cities. Output of nearly 500 million cubic feet daily last year was up 9½%. This year's deliveries are expected to reach 580 million cubic feet daily.

Romania's processing capacity has risen to about 240,000 bbl. daily. There has been a lack of modernization, however, and processing practices are reportedly wasteful. Thermal-cracking capacity, the only type in the country, has risen to 8 million barrels daily.

Practically all local crude continues to be refined at home. About two-thirds of the products are exported, mostly to Russia.

Rig Heads for Argentina

A FULLY WINTERIZED RIG is en route to southern Argentina where it will initiate a Union Oil Co. of California drilling program.

The outfit is being shipped from Houston to the tiny port of Puerto Deseado, 1,000 miles south of Buenos Aires. From there it will be moved to the first location on one of two parcels totaling 4 million acres in the provinces of Chabut and Santa Cruz, where Union Oil has a 27-year contract for exclusive exploration and development.

Because of the isolated wildcatting area, the rig and portable camp were assembled in Houston for checking, then dismantled for loading aboard ship.

India Sets Up Firm

. . . to market products of plants under construction.

INDIA IS SETTING up a state-owned marketing company to distribute products from refineries being built in Assam and Bahir Provinces.

A 15,000-bbl. plant at Gauhati, Assam, will be placed on stream in 1961, and a 40,000-bbl. refinery at Barauni, Bihar, will open in 1962 or 1963. The government is going into the marketing business now in order to have some experience behind it when the refineries open.

Until the government can start drawing on its own supplies, it will rely on imports. It says that attractive offers for products have been received from countries other than India's traditional suppliers. Presumably the offers are from Russia and Romania, which are helping India build the refineries.

As a starter, India plans to supply products for government requirements, amounting to 10 to 15% of the 122,000-bbl.-daily consumption. Marketers now selling in the country are Caltex, Stanvac, and Burmah-Shell.

Crude supplies are already in hand in the Nahorkatiya area of Assam, where 50,000-bbl.-daily potential is shut in.

WORLD BRIEFS . . .

Russia apparently intends to drill deeper holes. An equipment plant at Sverdlovsk is developing two types of heavy outfits rated at more than 16,000 ft. The country's deepest offshore well has just been bottomed at 14,482 ft. in the Caspian Sea, less than a mile off Karadag coast near Baku.

The first of two 140-ft. crude distillation units has been erected at British Petroleum's new 88,000-bbl. refinery at Dinslaken, West Germany. Two sections, each weighing more than 45 tons, were fabricated in the Rhur, transported to the refinery by road, and welded at the site. The second still will be set up in August.

The first bulk cargo shipment of Sun Oil Co. products to Australia has left Marcus Hook, Pa., by freighter for Melbourne. The 450 tons of oil is in special deep tanks. Previous shipments have been made in drums. The oil is consigned to Ramsay and Treganowan of Melbourne, Sunoco distributor.

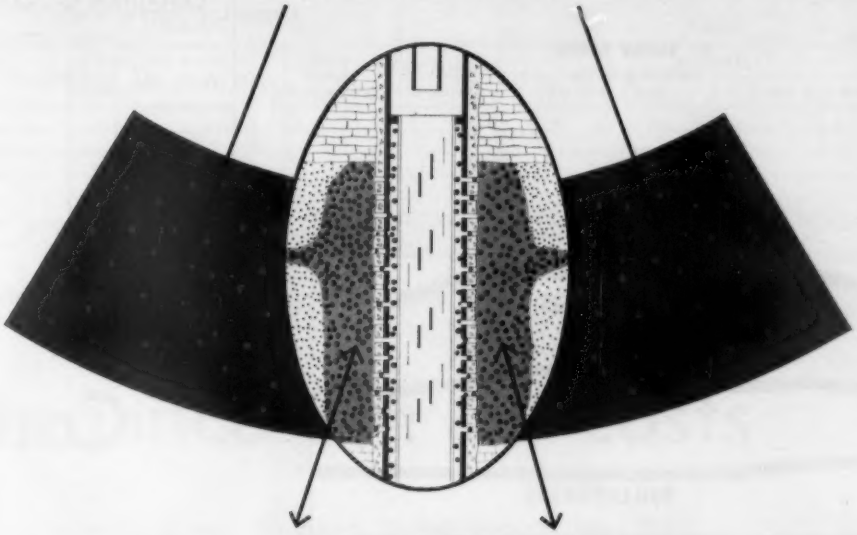
An exploration partnership has been formed by Gulf Oil Corp. and a private Spanish company, CIEPSA, which holds exploration rights on 14.8 million acres in Spain. The companies will bid for concessions in Spanish Sahara and Guinea.

Union Oil Co. reportedly has received government permission to loan $7 million to Maruzen Oil Co. for expansion of its 10,000-bbl. refinery at Matsuyama, Japan.

The 74,000-acre Block 5 in northern Monagas has been relinquished by Creole Petroleum Corp. after 11 dry holes. Creole paid $15.2 million bonus for the Venezuelan block 2 years ago. San Jacinto has given up a 24,000-acre tract in Apure, near the Colombian frontier.

One concession has been given up and another taken out by Pakistan Shell Oil Co. The new license covers a 3,000-sq.-mile area in Multan and Montgomery districts and in parts of Bahawalpur Division of West Pakistan. The rights lie north of the concession being surrendered. The lease will run for 3 years.

BEST FOR UNCONSOLIDATED SANDS!



FRACPAC

BY

HALLIBURTON

In oil-producing formations composed of unconsolidated sands, FRACPAC aids in the control or elimination of movement of silt and sand . . . and in many cases FRACPAC will help to stimulate the flow of oil.

Serving as an effective filter, FRACPAC process is a method of pumping predetermined amounts of specially graded and selected sand grains into the formation by conventional fracturing procedure until exposed zone indicates full capacity of materials. These special sand grains are sized and designed to prevent movement of fine formation sand . . . yet permit free-flow of formation fluids.

Application of the FRACPAC Technique is usually completed in 3 to 4 hours or less with the Halliburton Continuous Sand Proportioner as compared to other procedures requiring up to 48 hours or longer.

HOWCO HYFLO will aid materially in preventing possible emulsion development between placement fluid and formation fluids.

If you have an unconsolidated sand control problem . . . phone your Halliburton Fracturing Specialist today . . . and ask him about this revolutionary technique, FRACPAC.

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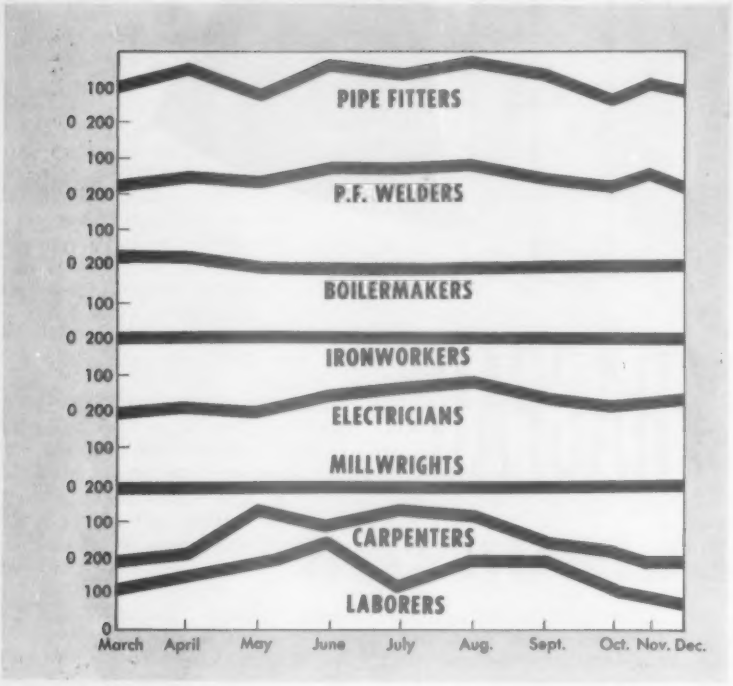
"CONTINUE TO LOOK TO HALLIBURTON—FOR LEADERSHIP"

BY LARRY RESEN
Refining Editor



CRAFT DEMAND for area around Sun Oil's Sarnia plant in Ontario. This is the 1959 forecast. Fig. 1.

CANADIAN OIL COMPANIES, LTD.
DATE _____ 19___ AREA ____

W.O. No.	Priority	Description

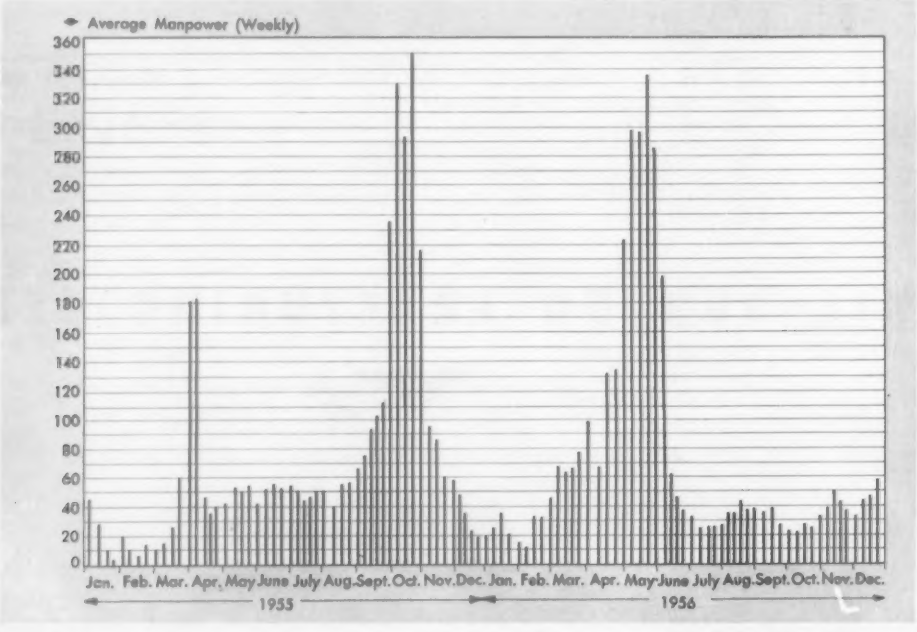
A refinery's daily work

Contract

CONTRACT maintenance, a growing factor in processing plants, works to hold a checkrein on plant-upkeep costs.

It functions primarily as a labor-supply surge drum during periods of heavy plant-maintenance requirements. When turnarounds take place and labor demands at a plant skyrocket, contract maintenance crews can step in and help to get the job done. Then the temporary contract-maintenance groups depart and the regular plant-maintenance force takes care of routine jobs.

With this arrangement the plant operator can, first of all, get his equipment back on stream in the shortest



TWO-YEAR RECORD shows fluctuations in manpower demand at Canadian Oil Co., Ltd., Sarnia plant. This is the catalytic maintenance force. Fig. 3.

FIG. 2

DAILY WORK SCHEDULE

PAGE ____ OF ____

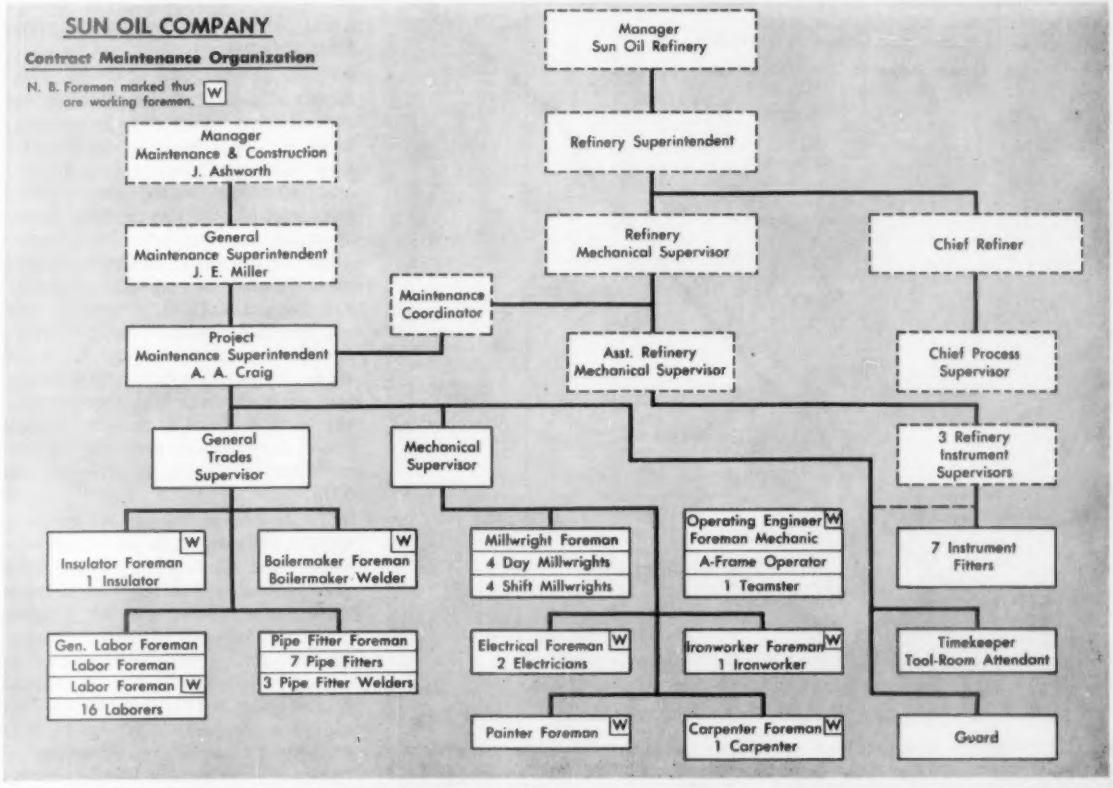
	Orig. Est.	Crafts	Crew and Seq.	Men X Hours (Scheduled)	Man-Hours Remaining	Men X Hours (Request)	Remarks: To The Field	Remarks: From the Field

schedule can show fluctuating labor needs. Some companies are finding . . .

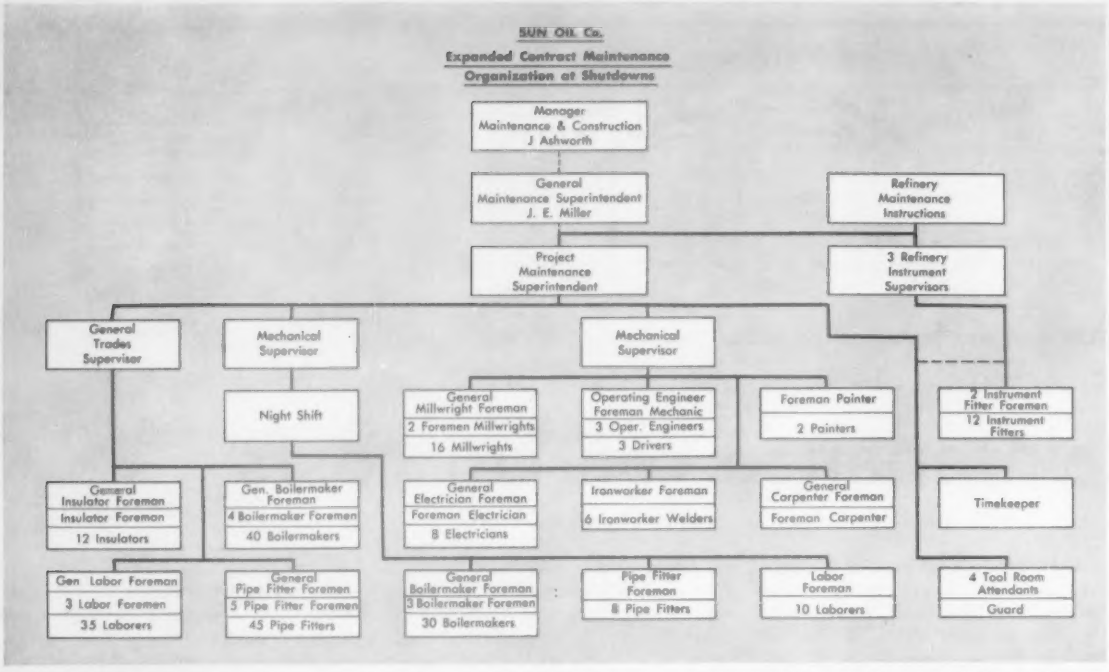
maintenance can cut costs

possible time. Additionally, he need not maintain extra men in his regular maintenance department to handle the big jobs. In some cases, he needn't invest in shop equipment, but can rely on the contractor to furnish little-used, expensive items.

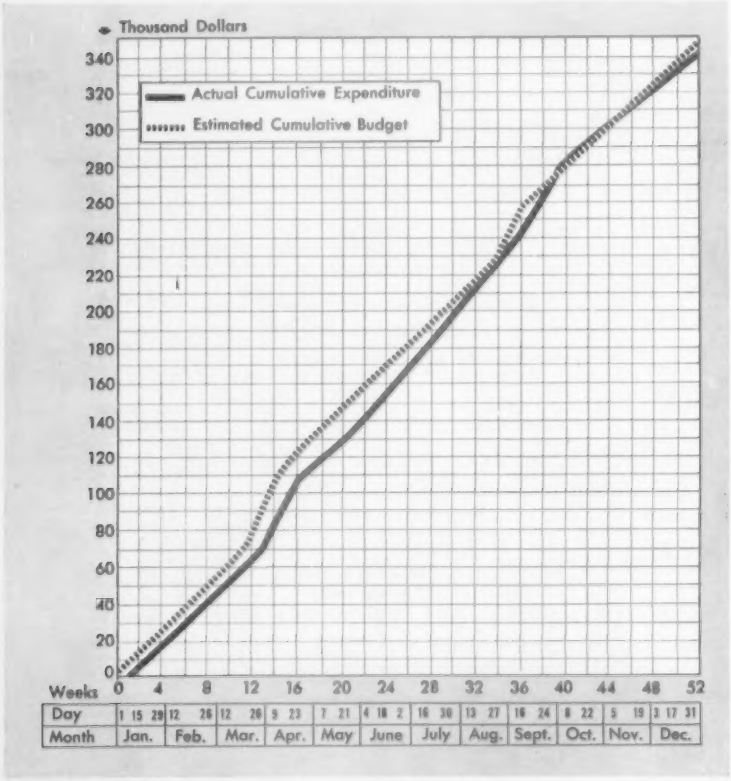
Adoption of contract maintenance by the industry is not following any set pattern. In many cases, the contractor is brought in to the picture only during the peak-requirement periods. This is especially true in the older plants with established maintenance work on a contract basis. Most notable of these are Tidewater Oil Co.'s giant installation at Delaware City, Del., Sun Oil's Sarnia plant, British American's Port Moody refinery, and Cities Service's Bronte, Ont. plant. The contractor in these cases must maintain the normal crews, schedule the big jobs, and provide additional temporary manpower at these times. The operator, meanwhile, can concentrate on running the plant. In some cases, such as with Sun Oil Co.,



LIAISON between Sun Oil Co. and Catalytic Construction of Canada, Ltd., is laid down in this organizational chart. Fig. 4.



DURING TURNAROUND organizational chart of contract maintenance crews is expanded to take care of the additional needs in the shortest possible time. Once the turnaround is over, the organization shrinks to its normal size. Fig. 5.



BUDGET CONTROL is maintained and closely adheres to estimates. A record of all maintenance labor expenditures is kept and charted weekly on a graph. This shows the relationship between estimated and actual expenditures on a weekly and accumulative basis for all labor costs. Fig. 6.

Ltd., Canada, this has resulted in the entire plant payroll being comprised of salaried personnel, the maintenance crews receiving their wages from the contractor.

Sarnia . . . One of the most interesting contract maintenance operations exists in Sarnia, Ont., where Catalytic Construction of Canada, Ltd., has several contracts with refineries and chemical plants. The variety in the contracts and the part the company plays in the area illustrate contract maintenance in practice. Catalytic maintains a staff of supervisory personnel—maintenance superintendents, trade supervisors, engineers, draftsmen, buyers, accountants and estimators—and these people, together with the local A. F. of L. unions, are in a position to handle any maintenance problem which may arise in the Sarnia area.

To ensure availability of manpower, the company each year checks the anticipated demands of contractors and companies in the Sarnia area. This enables plants with large fluctuating requirements to plan their shutdowns during the low-employment periods. This survey lists the various crafts and numbers needed by individual companies each month. The monthly totals required by crafts are compared against the number on the local unions' books, and shortages

noted. Arrangements can then be made for tradesmen to be brought in from out of town if necessary. With this labor chart plotted as a guide, (Fig. 1), a certain amount of schedule juggling will ensure manpower availability for the big turnarounds.

Two samples illustrate contract maintenance in action. The first is Canadian Oil Companies, Ltd. Here the contract maintenance crews supplement a permanent maintenance force. The second is Sun Oil Co., Ltd., where the entire maintenance job is performed by Catalytic.

Canadian oil . . . Under normal conditions at Canadian Oil, any supervisor may originate a work order which must be approved by the process supervisor of the area involved. The work order is then processed by the maintenance superintendent and planning office. Here it is decided whether the company crew will do the work or if it will be a contract maintenance job.

When capital expenditures are involved for additions or alterations, the work order is originated by a senior chief engineer or process supervisor. This is submitted to the chief engineer and refinery manager for approval. The approved work order is then passed through the engineer in charge of design and construction to the refinery-maintenance superintendent and planning office for processing. On work of this nature the contractor is responsible to the field construction engineer who in turn is responsible to the refinery-maintenance superintendent.

In planning meetings held daily, work orders are studied, work allocated, and daily work schedules made up. These are compiled daily to give complete information on work which is being performed on that particular day. A copy of this is seen in Fig. 2.

During its relations with Canadian Oil, Catalytic's work force has fluctuated widely. On some days it has dropped to practically nothing, on others it's gone up to as high as 400. A 2-year record is shown in Fig. 3, showing the extent of these fluctuations.

Sun Oil Co., Ltd., . . . The arrangement with Sun is much more extensive, but the contractor's main role remains almost unchanged. As the work load fluctuates, the permanent force is augmented by contract-maintenance crews. Only in this case, the permanent crews are also under contract maintenance.

Relationships between Sun and the contractor are laid down in the organization chart in Fig. 4. All direct

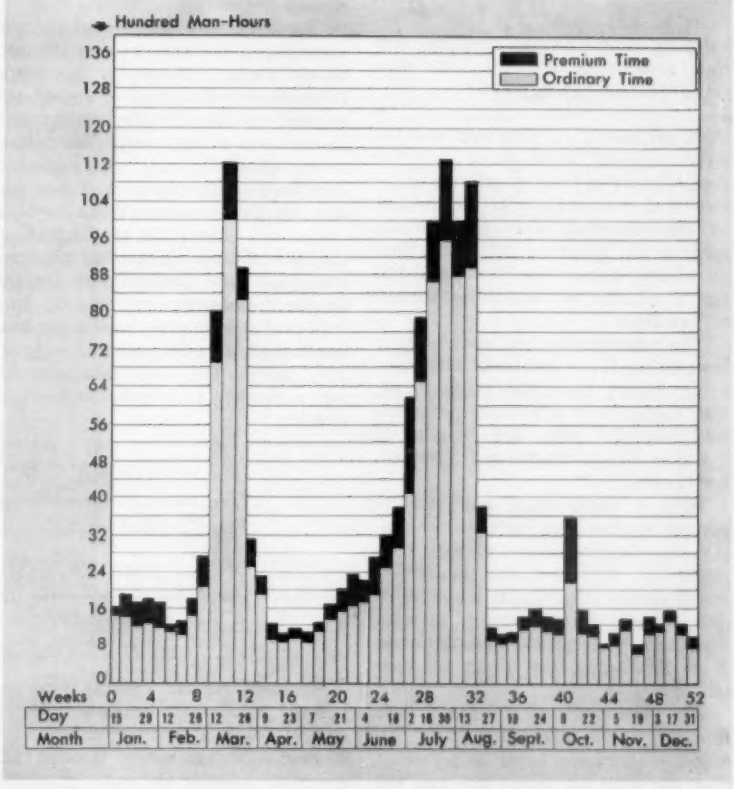
"In planning meetings held daily, work orders are studied, work allocated, and daily work schedules made up."

instructions are received from Sun's maintenance coordinator only. Expansion of the organization for a shutdown is graphically shown in Fig. 5. The basic work force is expanded to take care of the additional needs in the shortest possible time. Once the turnaround is over, the organization shrinks to its normal size. Sun's advantage in this case is the same as Canadian Oil's: peak labor requirements do not upset the normal crews nor do they require abnormally high permanent labor forces.

Work orders originate in various departments and are processed by Sun's planning group, which includes the refinery's mechanical supervisor, senior process shift supervisor, and maintenance coordinator, and Catalytic's maintenance superintendent. This group functions like any other refinery planning group: eliminating duplication; assigning priorities, and deferring nonessential items.

An annual budget set up by Sun governs the maintenance expenditures by the contractor. Hence, while this budget is controlled by Catalytic's maintenance superintendent, it must also be adhered to by him. Estimated labor costs for all maintenance services except shutdowns, estimated labor costs for planned shutdowns, and estimated cost of rented equipment are the three budget categories.

A record of all maintenance labor expenditures is kept and charted weekly on a graph (Fig. 6). This shows the relationship between estimated and actual expenditures on a weekly and accumulative basis for all labor costs. A graph is also kept to record the variations in manhours expended weekly throughout the year (Fig. 7). Rental logs are kept on all equipment to insure close cost control. Finally costs codes are used to allocate expenses, giving both Sun and Catalytic a close check on expenses. This method controls costs, insures minimum expense to the refinery, and guides the contractor in living within his budget.



VARIATIONS in manpower and amount of premium time is charted for planning purposes. Fig. 7.

Automation in cathodic protection

. . . using pipelines for data transmission

Unique system is operating successfully on short lines in Italy. Technique has long been considered in this country and some experiments have been made. Line attenuation is drawback which limits application to short distance unless equipment is provided to overcome the problem.

BY RAFFAELE GIROTTI, FRANCO SALIMBENI, RINO RIGHETTI, AND ANGELO GIANI
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ITALY'S GAS PIPELINES cross densely populated and highly industrialized areas. Hence, there are a great many direct-current rail and tramways. These cause extreme electrical fields in the soil, which in turn cause the corrosion of buried pipelines.

This problem led to the study of automatic devices and it has been successfully met by adopting such automatic control devices in cathodic-protection systems. Since Italian laws prescribe that lines be cathodically protected constantly, their electrical state must be checked continuously.

In the early stages, inspections and measurements were carried out by technical crews. But it is easy to understand how complicated this kind of work was; its effectiveness was dependent on the accuracy and reliability of equipment. The idea of developing telemetering facilities was thus considered and the first step taken toward automation.

First systems . . . The first systems were designed at Verbania and Verona. Here there was continuous control of characteristic quantities related to the electrical state of pipelines (pipe-to-soil potential difference and circulating current on pipelines), and for a number of quantities related to gas flow.

The transmission line used in both installations is a Patterson telephone cable, buried along the gas-line axis. The cables have a variable potentiality of 10-20 pairs and lengths of 6,400 m. for Verbania and 7,300 m. for Verona.

Next a telemetering and remote-control system was installed to control the electrical state and flow conditions of a line routed mainly in mountainous areas which are of difficult access during winter months. There are 34 electrical quantities and 7 gas-flow quantities which are controlled.

The most economical solution was found to be the installation of a polyethylene telephone cable at the same time the pipe was being laid and the use of a direct-current potentiometer-operated telemetering system. Furthermore, the automatic (or in alternate manual) telesection of measurements has been developed by means of adequate remote-control equipment with related continuous cyclic recording of electrical quantities.

The transmission line used in these installations is a company-owned telephone cable, because of economic convenience. The high costs of the systems developed were mainly due to the cost of the transmission line. It is, therefore, easy to understand why their study was necessary to obtain significant economic advantages.

For this reason, at the beginning, the idea of utilizing existing pipelines was taken into consideration for the remote transmission of control data. In a preliminary examination the economical advantages appeared satisfactory, and the line safety thus achieved was equivalent to or superior to those existing.

Recently remote control was developed in a major pressure-reducing station using a microwave channel. Transmission-line safety through supervisory control via radio generally involves higher costs because radio equipment must be doubled.

Use of Pipelines

Generally, an electrically insulated buried pipeline may be compared to the usual conductor line and therefore be used for remote transmission of data with the ground as a second conductor. By virtue of this analogy, once pipeline primary constants are known, the computation of attenuation, phase constants, and characteristic impedance is theoretically possible using conventional line formulas.

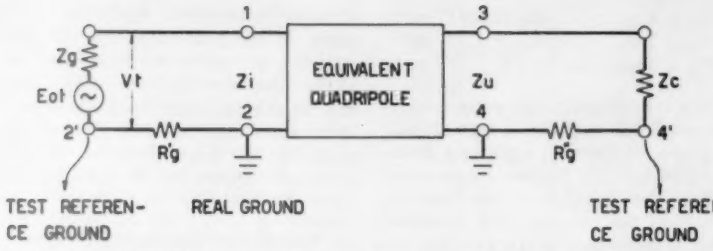
However, the problem presents serious difficulties because pipelines have a relatively high dispersion conductance concentrated in many points, such as coating holidays, railroad crossings, ducts, vents, etc. These may impeach the theory of distributed-constant circuits. Apart from this consideration, the greatest difficulty lies in calculating line inductance. This is a function of pipeline physical-geometrical characteristics and the space surrounding it, according to the following approximative expression:

$$L = \frac{Mf\ 10^3}{2\pi(d_2^2 - d_1^2)} - [(d_2^2 - d_1^2)/2 - d_1^2 \ln d_2/d_1] + \frac{2\,Mt\ 10^3}{\pi(4h^2 - d_2^2)} [h^2 \ln 2h/d^2 - (h^2 - d_2^2)/8]$$

(in henrys per kilometer) where:

- Mf = magnetic permeability of pipeline steel, h./m.
- Mt = magnetic permeability of soil, h./m.
- d_2 = pipeline o.d., mm.
- d_1 = pipeline i.d., mm.
- h = distance of pipe axis from ground surface, mm.

Presented at the Fifth World Petroleum Congress, New York City.



ELECTRICAL PATTERN of a pipeline used as a conductor. From a general point of view, a buried line may be patterned as an equivalent quadripole, provided with an input and output terminal, both ground-connected, and the other two (constituted by the pipe) insulated. Fig. 1.

The magnetic permeability of steel as well as that of surrounding soil must therefore be known. In a first approximation, it may be assumed that soil permeability is constant and the same as air permeability (Mt = Mo = 1.256 10^{-6} h./m.). The permeability of iron is strongly affected by direct current circulating on the pipeline following the application of cathodic protection.

Hence, according to an exponential law, inductance is not constant but is a function of distance. If we add to this difficulty caused by the protection current being overlapped by fluctuations caused by stray currents, we must conclude that the most rapid and fruitful way to the solution of the problem is through experimentation.

The theoretical possibility of transmission has been confirmed by the first experimental tests carried out on different types of pipelines. The equipment used to demonstrate the process consists of an audio-frequency oscillator, two variable resistors, and two voltmeters. Due to high line attenuation it was necessary to use low-distortion power amplifiers such as the sound-reproduction type. On the other hand, since required amplifier technical features are simple, the cost is low and the output transformer may normally be used in impedance matching.

The objective of this second testing cycle was to determine the parameters characterizing the transmission. These are attenuation, equivalent stability, the effect of ground connections, etc. From a general point of view, a buried pipeline may be patterned as an equivalent quadripole, provided with an input and output terminal, both ground-connected, and the other two (constituted by the pipe) insulated (Fig. 1).

While the latter are readily accessible, the former are accessible only through more or less high ground resistances. Understandably, therefore, pipeline characteristics, determined experimentally, are a function of ground resistance. And since the values of the latter are generally quite different, a correct comparison between the characteristics must be made by "zeroing" ground resistances.

Experimental tests have pinpointed the following facts:

- Pipe input impedance is independent of the load value inserted in equivalent quadripole output terminals.
- Maximum power transmitted and received is obtained by closing the equivalent quadripole on image impedances.

Table 1 shows attenuation values for each frequency of a 12-in. diameter pipeline 8,740 m. long, connecting a gas field to an intermediate compressor station. The values observed in the table have been plotted (Fig. 2) and a curve closely approximating the distribution of points controlled has been fitted by means of statistical methods based on the least-squares theory.

The type of this curve's equation is:

$$y = a + bx + cx^2$$

As may be observed in Fig. 2 on this page, attenuation is an ever-

TABLE 1

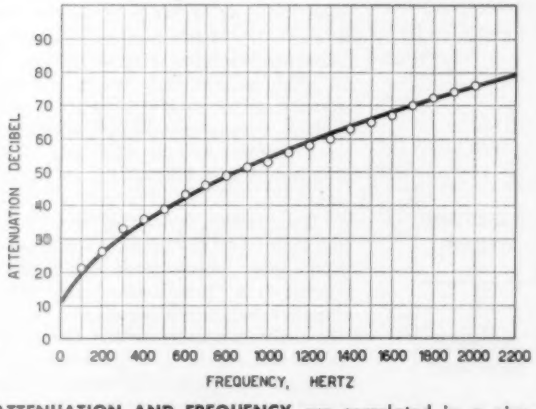
Attenuation Value vs. Frequency of a 12-In. Diameter, 8,740-M. Long Pipeline (Fig. 2)

Frequency Hz	Attenuation db	Frequency Hz	Attenuation db
20	12	800	49
50	16	900	51
75	19	1,000	53
100	21	1,100	56
150	24	1,200	58
200	26	1,300	60
250	30	1,400	63
300	33	1,500	65
350	34	1,600	67
400	36	1,700	70
500	39	1,800	72
600	43	1,900	74
700	46	2,000	76

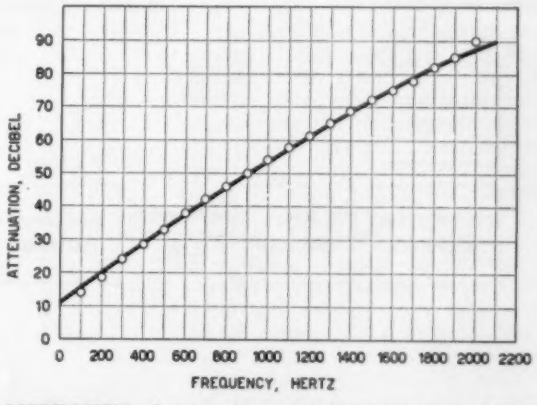
TABLE 2

Attenuation Value vs. Frequency of a 7-In. Diameter, 9,340-M. Long Pipeline (Fig. 3)

Frequency Hz	Attenuation db	Frequency Hz	Attenuation db
50	11	900	50
100	14	1,000	54
150	17	1,100	58
200	19	1,200	61
250	22	1,300	65
300	24	1,400	69
350	27	1,500	72
400	29	1,600	75
500	33	1,700	78
600	38	1,800	82
700	42	1,900	85
800	46	2,000	90



ATTENUATION AND FREQUENCY are correlated in a pipeline 8,740 m. long. Fig. 2.



CORRELATION of attenuation and frequency in a pipeline 9,340 m. long. Fig. 3.

increasing function of frequency. The curve's outline is similar to that of a homogeneous line, except for the very high attenuation values. It is to be noted, in fact, that at a frequency of 2,000 Hertz (Hz), attenuation has a value of 76 db, and thus the frequency band suitably utilizable for transmissions is small.

Table 2 shows attenuation values for each frequency of a 7-in. diameter pipeline, 9,340 m. long, connecting two pressure stations. The observed values have been plotted in Fig. 3. Since the curve's equation is of the $y = a + bx + cx^2$ type, it may be seen that attenuation is an increasing function of frequency.

Basic Pattern of Data Transmission

Frequency or time-division telemetering equipment has to be used. Figs. 2 and 3 emphasize the rapid increase of attenuation with frequency. Hence, when many measurements of the same station are to be transmitted, time-division systems are suitable (for instance coded - impulse telemetering) while frequency-division systems may be adopted when the number of measurements is limited.

Due to sharp line attenuation, data must be transmitted through amplifiers. Amplifier power is determined according to line attenuation and noise. Selection of ground-resistance values is determined by means of appropriate diagrams based on values observed experimentally.

These considerations show that a determination of the elements required for this type of transmission is very simple and similar to that used for the conventional determination of homogeneous lines.

Fig. 4 illustrates a block diagram of the simplest type of installation used for telemetering purposes between the two localities of Boltiere and Dalmine. These places are connected by a pipeline 6,770 m. long consisting in three pipe sections of the following diameters and lengths:

$D_1 = 8$ in.	$L_1 = 4{,}937$ m.
$D_2 = 7$ in.	$L_2 = 1{,}507$ m.
$D_3 = 5$ in.	$L_3 = 326$ m.

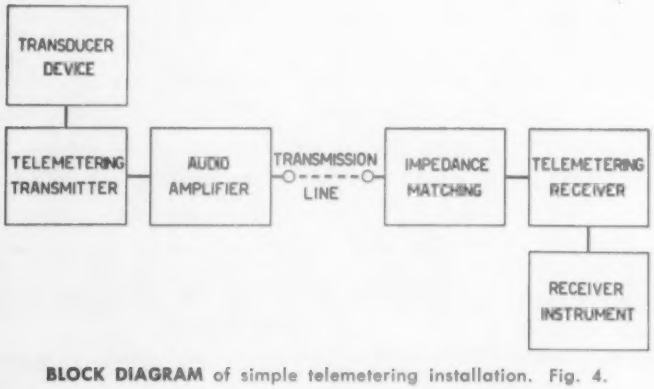
The telemetering equipment used is the amplitude-modulation type already employed to transmit a pressure measurement between the two locations by radio. The installation has been in operation for a year and measurement records have given excellent results. During the same period of time the transmission equivalent at the frequency of 1,500 Hz was recorded and it was found that there is a maximum variation of $\pm$ 2 db.

Currently the field of utilization of this transmission system is limited only by distance. This may be held to be an average of approximately 10 km. However, the possibility of increasing it by using appropriate equipment is now being studied.

The amplifiers need not be special except that they must have high output power and low distortion. Therefore, those used for sound reproduction may be satisfactorily used. From an economic aspect the cost of the pipe, considered as an electrical conductor, may be overlooked. Thus the cost of this type of telemetering or remote-control installation is limited to the cost of the data-transmitting and receiving equipment and amplifiers.

This type of transmission is satisfactorily used in telemetering facilities installed to control pipeline cathodic protection, performances of gas-distribution systems and, if required, as a measurement-collecting system in a radio - dispatching installation. From the standpoint of electrical continuity, frequency of failure may be considered nonexisting. Therefore line safety is very high. Maintenance costs are negligible.

Flexibility of utilization is very satisfactory because relocation of control points does not necessitate relocation of lines. This is a very important point in cathodic-protection control where changes in electrical fields may take place in the soil itself, due to new railroad or tramway lines, and to utility lines that dissipate direct current in the soil. Line attenuation is a drawback which limits the field of application to short distances, unless adequate equipment is provided to meet this trouble.



BLOCK DIAGRAM of simple telemetering installation. Fig. 4.

Natural-Gas-System Automation

The transmission line in a telemetering system represents a heavy financial burden. On the other hand, evolution toward automation requires a greater number of checks and controls and hence additional remotely controlled automatic equipment.

There is therefore an additional financial burden which makes it more difficult to apply automation in the technical development of operating companies. Therefore, equipment was studied and developed to resolve the many problems inherent in the Italian natural-gas transportation and distribution system with respect to safety and control.

Once again the problem of corrosion in buried pipelines stepped up the design of an automatic regulating device. In fact, variations in the electrical fields in the soil cause variations in the electrical state in the pipeline, which Italian regulations require must always be within safety limits.

This problem may be solved, but at great operating expense, by designing cathodic - protection installation equipment so that the voltages and currents guarantee the protection of the entire system during periods of unfavorable conditions. In this way, however, power consumption is much higher than that which is strictly necessary and the resulting soil voltage gradients are hazardous for pipelines.

An installation may be designed which automatically proportions its distribution of current according to the system's electrical state. An electronic device devised for this purpose and used on a large scale on the Italian natural-gas pipeline system is shown in the block diagram of Fig. 5. A reference electrode draws the difference of potential between pipe and soil. A comparison is made between the voltage to be regulated and another duly stabilized reference voltage.

The "error" voltage is brought to the inlet of an electronic power-amplifier outlet which feeds the control circuit of a "bridge amplystat." This supplies the current required to nullify the error (naturally within the limits of sensitivity). If, at a given time, the external electrical field creates a disturbance in the soil such as to upset the equilibrium, the device automati-

cally supplies a current such as to bring the error to zero again.

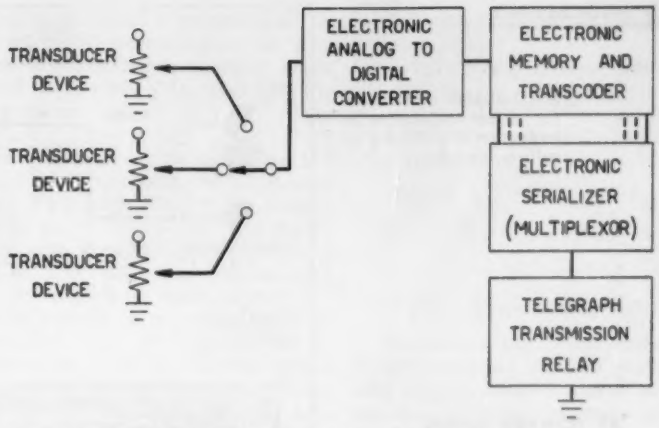
Correct operation requires placing the reference electrode where the pipe affected by the external field becomes anodic with respect to the soil. This limitation does not, however, impair the efficiency of line protection since the attenuation of the field of current created by the device so placed is more evident where pipe is naturally cathodic.

An effective application of this equipment was made in telemetering facilities for cathodic protection. Here it was possible to achieve remote regulation transmitting the pipe-to-soil potential to pilot the regulator. The regulation cycle is complete and automatic operation does not require data processing.

In the development of line automation the logical consequence of attempting to find a more convenient transmission line was to adopt a telemetering unit suited to the new carrier and capable of meeting gas-transportation and distribution requirements. Attenuation in a buried pipeline increases with frequency and hence the use of frequency-division telemetering systems is considered very expensive or inconvenient.

On the other hand, the development of automation in the field of gas transportation and distribution is showing a decided trend toward automatic data processing by means of digital - electronic computers. Automatically actuated controls, according to logical computer decisions, are the closing link of the regulation chain.

Digital-computer circuits require the insertion of digital data according to appropriate codes. Hence a coded telemetering system is particularly suited for this purpose since it avoids the preparation of tape or punched cards. The prime factor that brought about the development of a coded-impulse telemetering unit were mainly based on obtaining substantial savings on the transmission carrier and equipment. There was the eventual possibility of data processing (with the addition of appropriate control circuilts and code transformations).



DIGITAL ELECTRONIC encoding and transmission of data is shown on block diagram. Fig. 6.

These systems are used to advantage in the petroleum field but generally consist of relay systems and require code disks or other special equipment for the digital conversion of quantities. Digital electronic technique and use of transistors have made it possible to devise an all-electronic, low-cost and low-consumption unit. In the vacuum-tube version, the transmitter unit is provided with 300 crystal diodes and 35 vacuum tubes, while the transistor version consists of 100 transistors and approximately 300 germanium diodes.

Data are numerically transmitted in teletypewriter code and received by a conventional teletypewriter which reproduces data numerically on appropriate cards. From a functional standpoint, the numerical form is more satisfactory as the operator avoids instrument reading and periodic measurement recording. The card is also a record of any failures which may occur during a certain lapse of time.

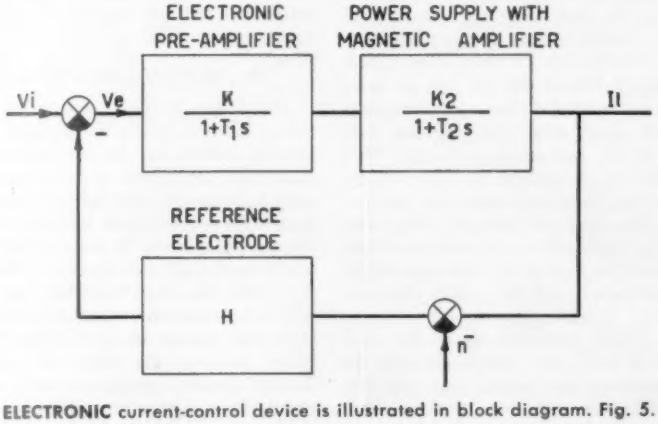
At the telemetering transmitter input, electrical voltages are forwarded sequentially in proportion to quantities to transmit (10 in the case of experimental prototype) which are obtained from conventional transducers of physical quantities in proportional electrical voltages.

The values of 10 quantities are converted every 6.4 seconds to the respective numerical values according to teletypewriter code. They are thus memorized under the form of parallel impulses. The transmission is by serial code impulses. No synchronism impulse is required to guarantee cyclic reception of data since a teletypewriter is used as a receiver. The frequency band is that used in telegraph transmissions.

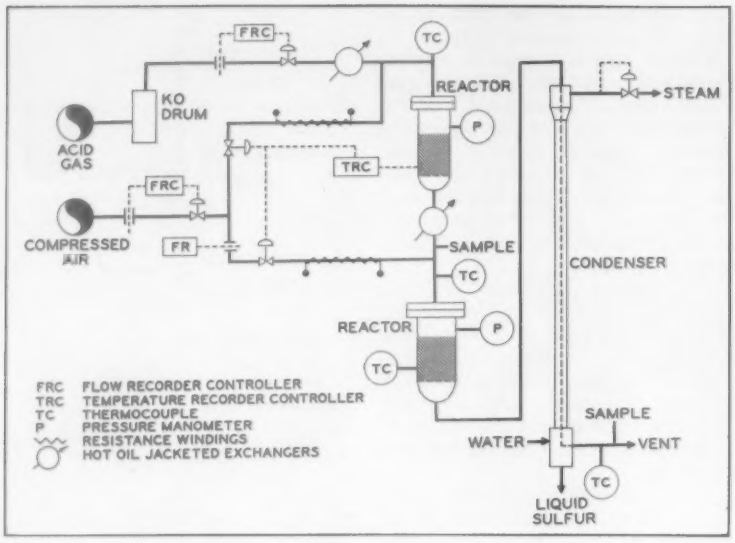
Theoretically there is no limit to the distances that may be reached. If radio waves are used as transmission carriers, a conventional chain of radio links may be used. If, instead, the transmission is by wire a simple telegraph line or an equivalent type of connection (pipe-to-soil) is sufficient.

The circuits are those usually employed in digital electronic, as illustrated in block diagram of Fig. 6. Parallel voltages on converted output, representing the numerical value of the quantity involved according to the teletypewriter code, are memorized by means of adequate bistable electronic circuits.

Serial transmission of parallel data is obtained through an electronic serializer. The serializer is perfectly static and consists of a matrix of crystal diodes and a chain of electronic bistable circuits. This part of the equipment is particularly interesting since there is a possibility of their being used in many other applications.



ELECTRONIC current-control device is illustrated in block diagram. Fig. 5.



PILOT-PLANT flowsheet for direct oxidation of hydrogen sulfide to sulfur. Fig. 1.

BY HOWARD GREKEL
Pan American Petroleum Corp., Tulsa

H_2S to S . . . by direct oxidation

Pan American Petroleum Corp. has investigated direct catalytic oxidation of H_2S to sulfur in the presence of gaseous paraffin hydrocarbons or other gases. It was found that H_2S could be selectively oxidized without concurrent oxidation of paraffin hydrocarbons. The process has been proved in bench scale and pilot plant. Economic comparisons indicate that for certain installations the investment for direct oxidation would be approximately 60% of that for the conventional Claus process plants.

PROCESSES presently used for the recovery of elemental sulfur from hydrogen sulfide are modifications of the Claus process. In this process one-third of the hydrogen sulfide is burned to sulfur dioxide, which is reacted with the remaining two-thirds of the hydrogen sulfide over a catalyst to yield elemental sulfur. Significant investment reductions appeared possible.

Commercial Possibilities

1. In applying the direct oxidation process, high space velocities are used and sulfur recoveries are independent of Claus equilibrium. For example, when two adiabatic reactors were used on a gas containing 15% H_2S and the maximum temperature in each reactor was 1,000° F., the actual recoveries were 70-75% of the sulfur in the feed compared to an equilibrium yield of about 50%. Where pipeline-gas specifications must be met, the direct-oxidation system would necessarily be followed by some process to remove the remaining sulfur compounds.

2. It has been estimated that in some cases the direct-oxidation plant would cost about 60% of that for a conventional Claus sulfur plant. It is also adaptable to small-tonnage plants such as might be encountered in some lean refinery streams.

3. The direct-oxidation system appears to have application in special situations. For example, when acid gases from a gas-sweetening unit are not combustible, hydrocarbon must be added before the gas can be used in a conventional plant. A direct-oxidation plant could be used on any gas which contained sufficient H_2S to justify preheating to 400° F. In general, the direct-oxidation process has the best advantage with low H_2S concentrations. At concentrations above 25% H_2S more than two stages are required and the plant cost advantage is lost.

4. Direct oxidation could be used when a very sour gas is recycled in repressuring operations and pipeline specifications are not applied. This situation is becoming more common as fields of less desirable gas compositions are being processed. In this case, H_2S could be removed without an amine unit and the product gases including the unchanged hydrocarbons would be used for repressuring. It is assumed that nitrogen dilution would be permissible. In an actual case study the sulfur represented 70% of the value of the gas and nitrogen contamination did not represent an economic objection.

From paper presented at Gas Conditioning Conference sponsored by engineering department of University of Oklahoma at Norman.

The Modified Claus Process

The Claus process is one of the oldest methods used to produce elemental sulfur by the oxidation of H_2S with air. I. G. Farbenindustrie used a two-stage form of the process, in which one-third of the H_2S was burned completely to form sulfur dioxide in the first stage. The product gas from this step was then blended with the remaining two-thirds of the H_2S and passed to a catalytic converter wherein the H_2S and sulfur dioxide formed elemental sulfur and water. In the present modified form

of the Claus process a number of stages (usually two) of catalytic reaction are used to increase yield of the sulfur since the high exit temperature in a single-stage converter could limit yields to about 75% of theoretical.

Sawyer et al. described a process for making sulfur from H_2S in Industrial Engineering Chemistry, Vol. 42, p. 1944 (1950). In the first step H_2S is oxidized with air in a furnace operating at approximately 1,900° F. The sulfur vapor and product gases are cooled to 750° F. and pass to two catalytic converters arranged in series with a sulfur condenser after each converter. The sulfur produced in the furnace is about 50% of theoretical and in conjunction with the two converters sulfur recovery is about 80%. In this process hydrocarbons fed to the furnace with the H_2S are converted to carbon dioxide. The carbon dioxide and some H_2S react in the furnace to form carbonyl sulfide. Some carbonyl sulfide passes through the catalytic reactors and is lost.

The Direct-Oxidation Method

It appeared that a process could be developed in which there was no furnace but only catalytic reactors. The process would be simplified and, if the maximum temperature in the catalytic reactors were limited, it might be possible to oxidize H_2S without simultaneously oxidizing light hydrocarbons in the feed gas. In such a system a major portion of the H_2S in a natural gas stream could be removed by direct oxidation to sulfur if the nitrogen diluent could be tolerated in the product gas.

A direct-oxidation process could be used to advantage when processing a mixture of carbon dioxide and H_2S too lean in H_2S to support noncatalytic combustion. In the standard process combustible fuel would have to be added to this acid gas to operate the furnace. It was also indicated that in direct oxidation the reactor volume could be smaller since the available data indicated the space velocities could be 10 times greater than in the Claus units.

Proving the Process

The effects of such variables as space velocity, temperature, H_2S concentration, and the presence of combustible gases other than H_2S were investigated with bench-scale equipment. The only catalyst investigated was a bauxite "Porocel sulfur-conversion catalyst," but other tests were conducted to determine a satisfactory diluent for this material.

To test the bench-scale results on a large unit, a pilot plant was operated. It produced a maximum of 10 lb. of sulfur per hour from the acid-gas stream which contained about 15% H_2S, 83% CO_2, and 2% hydrocarbons.

Bench scale . . . Approximately 110 runs were made with the bench-scale unit. Flow rates were varied from 2 to 45 s.c.f.h., and catalyst bed depths used were from zero (empty reactors) up to 2 ft. Wall temperatures were in the range from 300° to 900° F., which resulted in maximum bed temperatures from 400° to 1,500° F. Runs were made to simulate operations with acid gas (principal diluent carbon dioxide), H_2S-containing natural gas (sour natural gas), and refinery gases (olefins present). The effect of H_2S concentration was investigated over the range from 7 to 85% based on feed gas prior to air addition. Catalyst diluents such as common sand and pure quartz were also investigated in developing techniques to control the peak temperature when processing rich gases at high flow rates.

Pilot unit . . . This is shown schematically in Fig. 1. It comprised two 4-in.-i.d. adiabatic catalytic reactors with gas preheating, cooling, and sulfur-condensation facilities. It was operated in the field on gas containing approximately 15% H_2S, 83% CO_2, and 2% hydrocarbons. Approximately one-half of the air and all of the acid gas were injected into the first bed after preheating to reaction temperature. The remainder of the air was added between reaction stages after the interstage cooler.

The variables investigated were flow rate (600-1300 s.c.f.h.), per cent of theoretical air (90-120%), catalyst particle size (2-4 mesh and 4-8 mesh), and catalyst-bed depth (12 and 18 in.).

Variables in Direct Oxidation

At the beginning of the investigation it was assumed that the important variables in the direct H_2S oxidation were:

1. Space velocity or residence time.
2. Composition of feed gas.
3. Temperature of feed gas, reactor wall, and catalyst bed.

The variables were studied to determine their effect on conversion of H_2S and selectivity to sulfur. During the course of the work other variables found to be of importance which required further study were:

1. Effect of peak temperature on hydrocarbons in the feed.
2. Minimum feed preheat temperature.
3. Catalytic effect of reactor wall surface.
4. Effect of a catalyst diluent.

Reactions

Some of the possible reactions in this system are:

$$H_2S + 1/2\ O_2 \rightarrow S + H_2O \quad (1)$$

$$H_2S + 3/2\ O_2 \rightarrow H_2O + SO_2 \quad (2)$$

$$S + O_2 \rightarrow SO_2 \quad (3)$$

$$2H_2S + SO_2 \rightarrow 3/8\ S_8 + 2H_2O \quad (4)$$

Reactions 1 and 2 are primary reactions involving the feed gases, H_2S and oxygen, while 3 and 4 are secondary, involving products of the primary reactions.

Effect of Space Velocity

Conversion of H_2S . . . Throughput of feed gas was varied over a wide range in the laboratory and resulted in conversions from 10 to 97% of the H_2S fed. The range of space velocities was:

Space velocity	Minimum	Maximum
V feed/hr./V catalyst	875	300,000
V reactants/hr./V catalyst	128	50,000

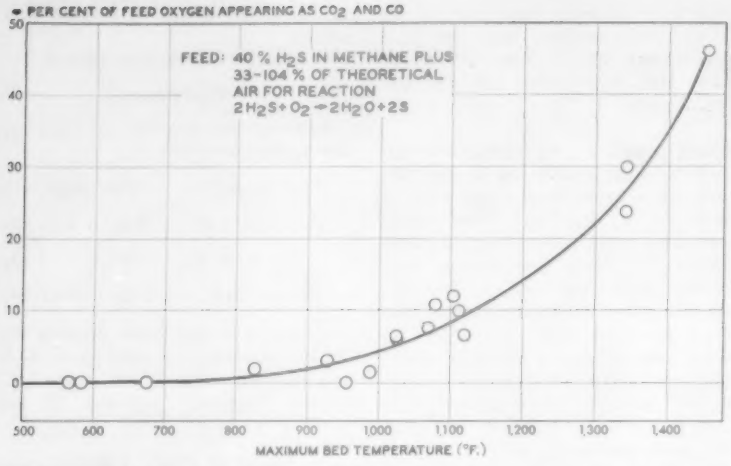
The gases used were 15% H_2S and 85% CO_2 for one series of tests and 40% H_2S in natural gas for another series. The theoretical air for Reaction 1 was varied from about 80 to 120%. It was found that increasing the space velocity resulted in a lower conversion of H_2S and at a given space velocity conversion increased with increased per cent theoretical air.

When stoichiometric air for Reaction 1 was used, it was found that sulfur dioxide was produced even at space velocities as high as 300,000 V/hr./V when only 20% of the oxygen was converted. Apparently, Reactions 2 and/or 3 proceed simultaneously with Reaction 1.

It is concluded that of the two primary reactions in the direct oxidation of H_2S over bauxite catalyst the partial oxidation of H_2S to sulfur and water predominates over the complete oxidation of H_2S to sulfur dioxide and water.

A linear relation was found for the logarithm of the ratio of the effluent oxygen/feed oxygen versus the reciprocal space velocity. This indicates either a first-order reaction or a diffusion-controlled reaction. Since temperature does not enter as a parameter in the correlation, it is believed that diffusion between the gas phase and the catalyst is the controlling factor.

Selectivity . . . The products from the



DIRECT OXIDATION of hydrogen sulfide to sulfur in methane. Effect of maximum bed temperature on hydrocarbon oxidation at 98-100% oxygen conversion. Fig. 2.

partial oxidation of H_2S consist of sulfur, SO_2, and H_2O. Even when the sulfur was dark in color, no other product of reaction was identified in the exit gas. The discussion of selectivity, therefore, is limited to the distribution between sulfur and SO_2.

At space velocities above 20,000 the selectivity of converted H_2S to sulfur is about 90 per cent, essentially independent of temperature. At these space velocities equilibrium is not controlling. The selectivity is controlled by the reaction rates of Reactions 1 and 2 and/or 3.

The effluent gas ratio

$$\frac{(H_2O)^2 \times (S_8)^{3/8}}{(H_2S)^2 \times (SO_2)}$$

was found to agree with the equilibrium constant at the effluent temperature at low space velocities. It is concluded that at low space velocities, the products react with unconverted H_2S and reach substantial equilibrium in accordance with the Claus reaction. Under such conditions, low effluent temperatures result in high yields of elemental sulfur.

Effect of Feed-Gas Composition

The two major factors in feed-gas composition are H_2S concentration and ratio of oxygen to H_2S.

H_2S concentration . . . The concentration of H_2S was changed in feed gas containing carbon dioxide or methane. It was found that, for a given space velocity of reactants, the H_2S conversion increased with increasing H_2S concentration. This is equivalent to increasing conversion with increasing residence time.

Per cent oxygen . . . As stated previously, the oxygen concentration was based on Reaction 1. It was found that, at a constant H_2S space velocity, conversion of H_2S was increased by increasing the per cent theoretical air. This corresponds to increasing conversion in spite of decreasing residence time.

The effect of ratio of oxygen to H_2S on the selectivity to SO_2 is shown by three runs in which the amount of oxygen was intentionally varied at a constant H_2S space velocity.

Run No.	% theoretical oxygen	Conversion of H_2S to S	Conversion of H_2S to SO_2
1	90	68.3	5.5
2	98	66.1	9.3
3	110	67.3	12.7

It is seen that the conversion of H_2S to sulfur does not change appreciably while the selectivity to SO_2 increases sharply with per cent theoretical oxygen.

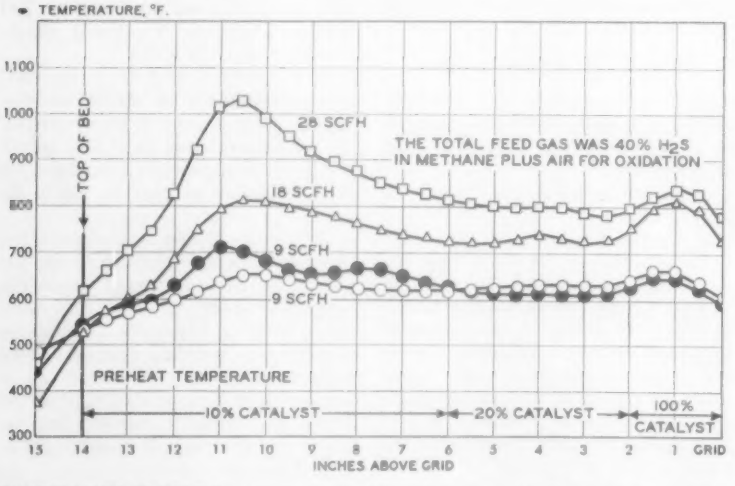
Effect of Temperature on H_2S Conversion

The effect of catalyst temperature was studied by controlling the inlet temperature and reactor wall temperature at a fixed feed rate and gas composition. In this manner the effluent temperature was varied. When either the oil-jacket temperature or feed-inlet temperature was less than 370° F. it was found that the reaction gradually slowed down and the "hot spot" or reaction zone gradually shifted from the inlet to the exit end of the reactor and the catalyst became inert.

At catalyst temperatures between 370° and 1,000° F., no distinct or significant effect of temperature on conversion of H_2S over bauxite could be detected from these results. It is concluded that at constant space velocity and feed-gas composition for catalyst temperatures between 370° and 1,000° F., there is no significant effect of temperature on the conversion of H_2S over bauxite catalyst. The temperature effect is apparently minor compared to the effects of space velocity and gas composition.

A very definite temperature effect on conversion is shown in an empty carbon-steel tube.

Run	Per cent conversion at 550° F.	700° F.	915° F.
Carbon-steel tube	8	12	58



TEMPERATURE PROFILE for composite bed bench scale oxidation of H_2S to sulfur. Fig. 3.

Effect of Temperature on Light Hydrocarbon Oxidation

Hydrogen sulfide, natural gas, and

air (in stoichiometric proportions for partial oxidation of the H_2S) were blended to a final concentration of 20% H_2S. Tests were made at various space velocities and wall temperatures to determine the effect of temperature on the oxidation of hydrocarbons. The data summarized in Fig. 2 indicate that the oxidation of hydrocarbons is low at peak temperatures below 1,000° F. At higher temperatures the oxidation of hydrocarbons becomes a competitive reaction until at 1,500° F. it becomes a predominant reaction.

It is concluded that H_2S can be partially oxidized to sulfur in the presence of light paraffinic hydrocarbons without excessive oxidation of the hydrocarbons if the temperature does not exceed 1,200° F.

Dilution of Catalyst with Quartz

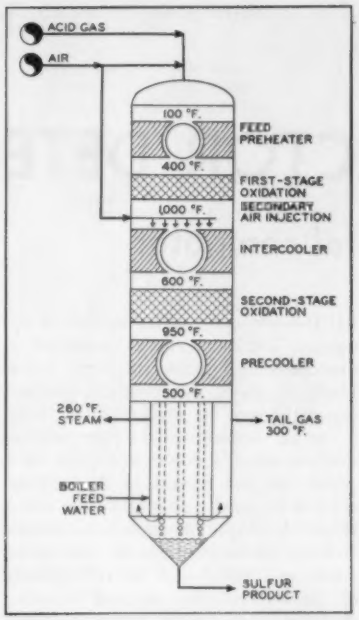
The oxidation reaction is very rapid and a sharp rise in temperature occurs in the catalyst bed. To avoid excessive oxidation of the hydrocarbons it is desirable to limit the peak temperatures in the reactors to 1,000° F.

Under 25% . . . When the H_2S concentration is 25% or less (before addition of the air) the peak temperature can easily be limited to 1,000° F. by using two adiabatic reactors, adding a portion of the air to the first reactor, intercooling, and adding the remainder of the air to the second reactor.

Above 25% . . . However, when the concentration of H_2S is higher than 25%, several adiabatic steps with intercooling and controlled air to each, or an internally cooled reactor would be required to control the temperature.

In the case of the internally cooled reactor some provision would have to be made to lengthen the reaction zone to avoid local high temperatures. Possible methods would include multiple injection of the gas or air, close tube spacing with large catalyst-particle size, or dilution of catalyst with a catalytically inert material. The internally cooled reactor was preferred, and several catalyst diluents were tried in the small bench-scale reactors, simulating one tube of an internally cooled reactor.

Temperature profiles . . . It was found that of readily available materials quartz was the least reactive catalyst diluent and aluminum was the least reactive metal which could be used for the reactor. A system was developed in which the inlet gas first passed over 8 in. of 10% bauxite, then 4 in. of 20% bauxite, and finally 2 in. of 100% bauxite. This arrangement gave 95% conversion of 40% H_2S in methane at a flow rate of 10 s.c.f.h. Fig. 3 illustrates the temperature profiles in this reactor arrangement at three different flow rates. In each run there was a peak reached in the 10% bauxite section, and in the 100% bauxite section. At the highest flow rate the conversion of H_2S was 86.5%.



PROPOSED CONVERTER DESIGN for direct oxidation of hydrogen sulfide to sulfur. Fig. 4.

The information from diluted catalyst runs indicate that it would be possible to design a tube reactor using a suitable catalyst diluent so that the high-temperature zone was lengthened and the peak temperature controlled.

Feeds With Unsaturated Hydrocarbons

Several runs were made in which the feed contained 10% propylene in addition to H_2S, carbon dioxide, and other hydrocarbons. The bauxite catalyst was deactivated rapidly and the sulfur product discolored. It was concluded that bauxite catalyst cannot be used for the direct-oxidation process in the presence of olefin hydrocarbons. A soda-lime type of catalyst has since been developed and patented by Standard Oil Co. (Ind.), which can be used for direct oxidation and will tolerate olefins in the feed gas.

Pilot-Plant Operation

The pilot-plant system described above was operated in the field for several weeks. Operation was successful and easy to control. The laboratory data and pilot-plant data were in good agreement.

"In general, the direct-oxidation process has the best advantage with low H_2S concentrations. At concentrations above 25% H_2S more than two stages are required and the plant cost advantage is lost."

Proposed Commercial Unit

There have to date been no commercial applications of the direct-oxidation process. An illustrative design for its application is shown in Fig. 4. Two catalyst beds are used with two preheaters and an intercooler. All the sulfur is condensed in a final condenser stage operated at 280° F. The units can all be placed in one assembly. The temperatures are adjusted to prevent sulfur condensation in the reactors and intercooler.

Conclusion

1. Of the primary reactions in the direct oxidation of H_2S over bauxite catalyst, the partial oxidation of H_2S to sulfur and water predominates over the complete oxidation to sulfur dioxide and water.

2. At low space velocities, the products react with unconverted H_2S and reach substantial equilibrium in accordance with the Claus reaction. Under such conditions, low effluent temperatures result in high yields of elemental sulfur.

3. At a constant H_2S space velocity conversion of H_2S is increased by increasing the per cent theoretical air in spite of the corresponding decrease in residence time.

4. At a constant H_2S space velocity and feed-gas composition, there is no significant effect of temperature on the conversion of H_2S over bauxite catalyst for catalyst temperatures between 370° and 1,000° F.

5. Hydrogen sulfide can be partially oxidized to sulfur in the presence of light paraffinic hydrocarbons without excessive oxidation of the hydrocarbons if the temperature does not exceed 1,000° F.

6. The direct-oxidation process has commercial possibilities in special situations.

New factor permits

Z FACTOR DETERMINATION

in a digital computer

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Phillips Petroleum Co.

ALL PHASES of natural-gas engineering require the use of compressibility factors (Z). These factors are available in charts or tables, as a function of pseudoreduced temperature and pressure, T_r and P_r, but in this form they are not readily usable in digital computers.

Attempts have been made to derive empirical equations to represent compressibility factors, but these have not proven satisfactory for the full range of T_r and P_r. For this reason, a table interpolation method was developed.

It was apparent that the accuracy with which compressibility factors must be reproduced is far greater than would be demanded by ordinary engineering considerations. Two primary reasons for this are that calculations done for the various regulatory bodies must be duplicable by hand calculation methods, and that calculations carried out in connection with gas contracts must be based on specified values of compressibility factors.

Storage space limited . . . The basic problem is to develop an interpolation method such that the computer using an internally stored condensed table of Z values can reproduce the original full-size table with the desired accuracy. The more entries contained in the condensed table, the more accurately a given interpolation method can reproduce the original table. Also, a more sophisticated interpolation method using a condensed table of a given size can reproduce the original table with greater accuracy than can a relatively simple interpolation method.

Since increasing both the size of the condensed table and the complexity of the interpolation method increases the computer storage space required, it is necessary to establish a compromise between the condensed-table size, interpolation method, and accuracy.

Only 400 entries used . . . It was determined that the desired accuracy could be obtained with a 20 by 20 table of compressibility factors at selected values of T_r and P_r. The key to the high accuracy obtained with this relatively small table is in the selection of the values of P_r to be used for the condensed table. Thus, in the region of maximum inflection of the chart the points are closely spaced and in the relatively linear regions the points are widely spaced. The selected values of T_r and P_r and the corresponding values of Z are given in Table 1.

The values of P_r at the two ends of the table ($P_r = -0.20$ and $P_r = 20.0$) and the resulting Z's are dummy values which are required for the cubic interpolation. No attempt is being made to authenticate these end values of the Z factors given in Table 1; the values were chosen only for their ability in causing more accurate duplication of the parent table. It is believed that the values of T_r and P_r given in Table 1 could be used with any set of natural-gas compressibility factors. For a more general table of

TABLE 2—METHOD OF INTERPOLATION

	T_{r1}	T_{rj}	T_{r2}
P_{r1}	Z_{11}	Z_{1j}	Z_{12}
P_{r2}	Z_{21}	Z_{2j}	Z_{22}
P_{ri}		Z_{ij}	
P_{r3}	Z_{31}	Z_{3j}	Z_{32}
P_{r4}	Z_{41}	Z_{4j}	Z_{42}

Table 1—Condensed Table of Natural-

P_r (pseudoreduced pressure)	T_r (pseudored									
	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50
−0.20	1.058	1.048	1.041	1.040	1.036	1.023	1.029	1.033	1.014	1.021
0.00	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+0.40	0.868	0.889	0.901	0.916	0.928	0.934	0.942	0.949	0.953	0.959
0.70	0.746	0.785	0.819	0.850	0.871	0.885	0.898	0.911	0.921	0.930
1.00	0.588	0.669	0.733	0.779	0.812	0.837	0.856	0.875	0.889	0.902
1.20	0.443	0.579	0.672	0.731	0.773	0.804	0.829	0.850	0.869	0.884
1.30	0.353	0.530	0.640	0.707	0.753	0.789	0.817	0.839	0.859	0.876
1.40	0.266	0.480	0.605	0.682	0.732	0.773	0.803	0.828	0.850	0.868
1.50	0.256	0.426	0.571	0.658	0.710	0.757	0.791	0.817	0.841	0.859
1.60	0.251	0.394	0.541	0.634	0.691	0.743	0.779	0.805	0.832	0.851
1.80	0.260	0.371	0.497	0.592	0.656	0.712	0.755	0.784	0.815	0.837
2.00	0.281	0.370	0.467	0.554	0.626	0.687	0.732	0.766	0.799	0.824
2.50	0.343	0.394	0.451	0.519	0.582	0.638	0.688	0.728	0.765	0.796
3.00	0.407	0.441	0.490	0.535	0.582	0.625	0.669	0.707	0.745	0.777
4.00	0.534	0.560	0.582	0.608	0.633	0.653	0.687	0.715	0.746	0.776
5.00	0.664	0.672	0.683	0.694	0.710	0.721	0.742	0.761	0.787	0.811
7.00	0.904	0.897	0.893	0.891	0.889	0.891	0.896	0.904	0.914	0.924
10.00	1.230	1.210	1.193	1.176	1.164	1.152	1.145	1.140	1.135	1.131
15.00	1.753	1.720	1.682	1.645	1.616	1.588	1.558	1.529	1.508	1.493
20.00	2.230	2.270	2.180	2.110	2.090	2.020	2.000	1.930	1.850	1.810

TABLE 3—DEVIATION OF CALCULATED VALUES FROM TABLE VALUES OF COMPRESSIBILITY FACTORS

P_r	T_r	Z table	Z calc.	Deviation (Z calc.-Z table)	Per cent deviation (Dev. / Z table)
0.65	1.15	0.835	0.833	−0.002	−0.240
5.65	1.10	0.745	0.745	0	0
7.30	1.20	0.920	0.920	0	0
8.70	1.30	1.039	1.038	−0.001	−0.096
11.35	1.35	1.257	1.256	−0.001	−0.080
14.15	1.35	1.486	1.487	+0.001	+0.067
1.55	1.60	0.886	0.886	0	0
5.25	1.40	0.775	0.776	+0.001	+0.129
8.50	1.50	1.025	1.024	−0.001	−0.098
13.45	1.90	1.323	1.324	+0.001	+0.076
2.50	2.80	1.009	1.009	0	0
2.65	2.40	0.980	0.980	0	0
3.95	3.00	1.034	1.034	0	0
6.10	1.90	0.970	0.969	−0.001	−0.103
7.75	2.80	1.099	1.100	+0.001	+0.091
10.40	3.00	1.180	1.180	0	0
11.30	2.60	1.209	1.208	−0.001	−0.083
14.20	1.90	1.363	1.364	+0.001	+0.073

compressibility factors, slight adjustment might be required in these values.

Method . . . The use of this program is illustrated in Table 2. Here, elements subscripted with i and/or j are interpolated values.

The program is entered with given values of the pseudoreduced pressure and temperature, P_{ri} and T_{rj}, and locates two stored values of T_r (one on each side of T_{rj}) and four stored values of P_r (two on each side of P_{ri}). The eight corresponding values of Z are selected, and a linear interpolation is made to obtain four values of Z at T_{rj} (Z_{1j}, Z_{2j}, Z_{3j}, Z_{4j}). These four values of Z and the four values of P_r (P_{r1}, P_{r2}, P_{r3} and P_{r4}) are then fitted to a cubic equation and the value of Z_{ij} is calculated by substituting P_{ri} in the equation.

Results . . . This method was tested using the table of compressibility factors in "Drilling and Production Practices, 1952", p. 280 (published by API). A random check of 111 values of Z from this table was made with the following results:

1. Positive deviation, 60% of points, average deviation +0.059%.
2. Negative deviation, 40% of points, average deviation −0.061%.
3. Absolute deviation, 82% of points, deviation <0.100%.
4. Absolute deviation, 96% of points, deviation <0.200%.
5. Largest deviation, 0.33%.

A more comprehensive comparison of the table indicated deviations of about the same magnitude except for a maximum deviation of about 1.0% in the region around $T_r = 1.05$ and $P_r = 1.50$. In this region the values of Z are about 0.251, and the maximum absolute deviation was only about ± 0.003. Since most natural-gas engineering calculations will not be made in this region, it was considered unnecessary to attempt to reduce this deviation.

Table 3 presents a tabular list of data and results indicating the percentage deviation of the calculated values of Z from the parent-table values of Z. In this table, the calculated values of Z are rounded off to the nearest 0.001 and the percentage deviation is calculated from these values. It is felt that the column showing absolute deviation more clearly indicates the accuracy of the method.

Conclusions . . . This method can reproduce compressibility factors with an accuracy satisfactory for most natural-gas engineering calculations. The method should be applicable to any table or chart of natural-gas compressibility factors.

ACKNOWLEDGMENT: The authors express their appreciation to Phillips Petroleum Co. for permission to publish this article.

Gas Compressibility Factors

uced temperature)

1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00
1.016	1.013	0.010	0.009	1.007	1.009	1.002	1.001	1.000	0.999
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.968	0.975	0.980	0.983	0.987	0.992	0.996	0.998	1.000	1.002
0.945	0.958	0.967	0.973	0.978	0.986	0.992	0.997	1.001	1.004
0.924	0.941	0.953	0.961	0.970	0.981	0.989	0.996	1.001	1.007
0.909	0.931	0.945	0.955	0.964	0.978	0.987	0.996	1.002	1.008
0.901	0.925	0.941	0.952	0.962	0.977	0.987	0.996	1.002	1.009
0.895	0.920	0.938	0.949	0.960	0.975	0.986	0.996	1.002	1.010
0.889	0.915	0.934	0.946	0.957	0.974	0.985	0.995	1.003	1.010
0.882	0.910	0.930	0.943	0.954	0.972	0.984	0.995	1.003	1.011
0.871	0.900	0.924	0.939	0.950	0.970	0.983	0.995	1.004	1.012
0.861	0.893	0.918	0.933	0.947	0.968	0.982	0.995	1.006	1.014
0.840	0.876	0.904	0.924	0.941	0.963	0.980	0.995	1.009	1.019
0.825	0.865	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024
0.818	0.856	0.892	0.916	0.939	0.968	0.990	1.007	1.023	1.035
0.847	0.879	0.912	0.935	0.955	0.988	1.012	1.027	1.039	1.049
0.945	0.958	0.967	0.973	0.978	0.986	0.992	0.997	1.001	1.004
1.130	1.132	1.136	1.141	1.143	1.156	1.158	1.162	1.164	1.167
1.470	1.442	1.424	1.406	1.390	1.362	1.347	1.340	1.336	1.333
1.760	1.680	1.660	1.620	1.510	1.470	1.420	1.450	1.430	1.440

NOMENCLATURE

P_r — Pseudoreduced pressure.
T_r — Pseudoreduced temperature.
Z — Compressibility factor — PV/RT.
P — Absolute pressure.
V — Molar volume.
R — Gas constant.
T — Absolute temperature.

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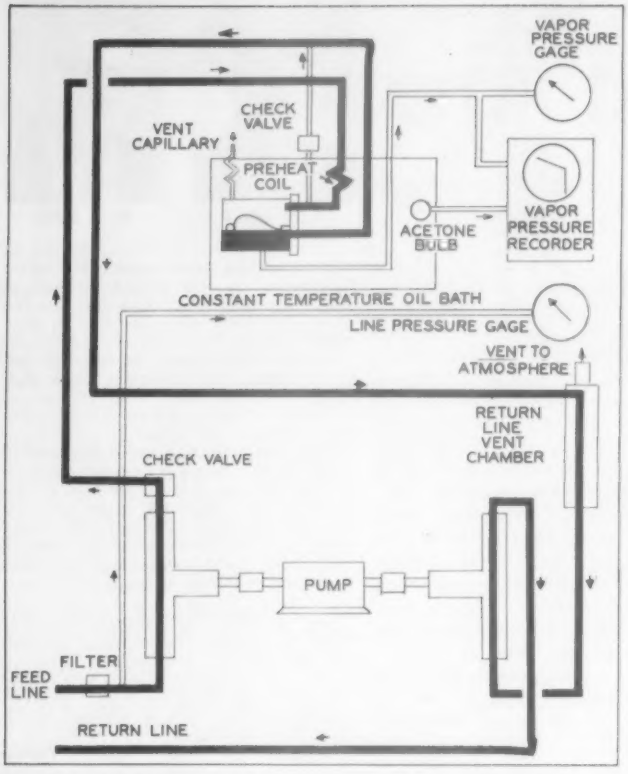
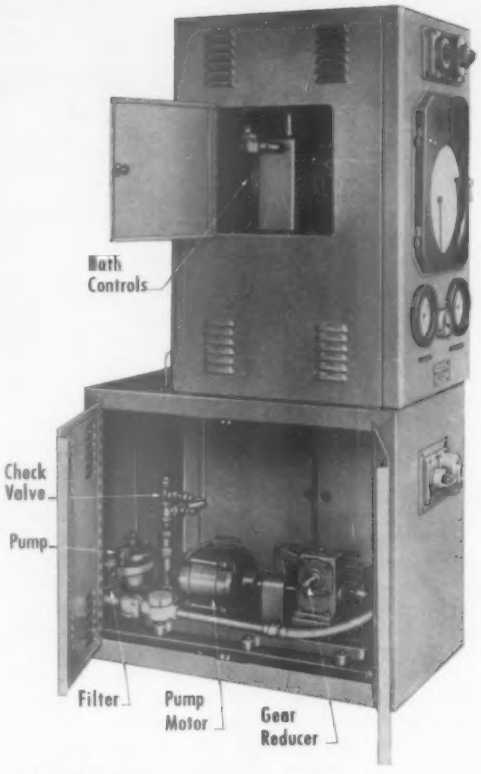


OPERATIONAL FEATURES of the continuous Reid vapor pressure analyzer. Fig. 1.



CONSTRUCTION of the equipment is shown in this photo. Fig. 2.

Continuous R.v.p. analyzer cuts gasoline blending time in half

WOULD you like to sell butane as gasoline? Cut gasoline-blending time in half? Reduce laboratory tests?

At Magnolia Petroleum Co.'s Beaumont, Tex., refinery we have done all these with a continuous vapor-pressure analyzer. With this instrument, gasoline blending was revolutionized from a tedious trial-and-error—add, test, wait, and hope—method to a systematic quick, continuous addition of butane.

The continuous automatic Reid-vapor-pressure analyzer installation has proved successful because:

- The sampling system is simple and effective.
- The instrument is accurate. Yet it is simple, rugged, and not oversensitive on any of its operating features.
- A strict maintenance schedule was set up and has been followed.
- Personnel in blending operations gave their complete cooperation.

Paper presented at University of Oklahoma instrumentation symposium, 1959.

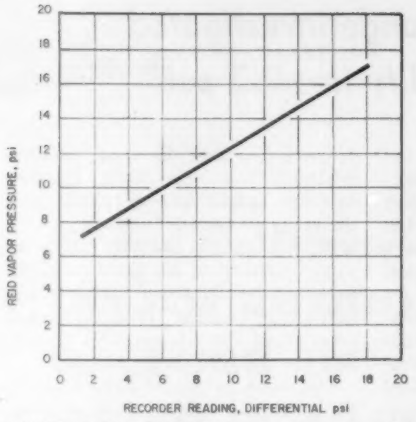
. . . and in addition

- A significant amount of butane upgraded to motor gasoline.
- Closer control of product vapor pressure maintained.
- Tank reworking eliminated.
- Laboratory R.v.p. tests reduced by 1½ per blend or over 100 per month.

BY W. R. FOSTER AND P. H. RICHER
Magnolia Petroleum Co.

Butane pressuring . . . Butane is the gasoline-pressuring agent used by most refineries. Since it costs roughly half the price of gasoline, every refiner is anxious to blend as much as he can. Gasoline specifications are written with a maximum but no minimum vapor pressure. This limits the quantity of butane which can be used.

If a blender adds too much pressur-



CALIBRATION CURVE for automatic Reid vapor pressure recorder. Fig. 3.

ing stock, he must rework his blend.

This means a possible delay in shipment and considerable additional work. The blender tries to avoid the problem by applying a personal safety factor.

Refiners in making certain they do not exceed the specifications frequently ship motor gasoline somewhat below the maximum vapor pressure. Our refinery was no exception. Our records showed that approximately 12% of our shipments were below the maximum Reid vapor pressure by 0.3 to 0.4 psi. In addition, another 30% were 0.1 to 0.2 psi. below the maximum. Close blending with a continuous, accurate indication of vapor pressure would permit upgrading more butane to gasoline.

Getting only the 12% in the 0.3 to 0.4 range into the 0.1 to 0.2 range would provide a good payout for a stream analyzer. We based our recommendations on this concept; but the analyzer did even better. Additional justifications were: better product control, saving of tankage, saving of manpower, eliminating need for reworking blends, and reducing laboratory tests.

Analyzer requirements . . . Process-stream analyzers may be compared to small, highly specialized automatic laboratories. They should provide analytical information with a high degree of accuracy and reliability.

Selecting the proper stream analyzer for this application required careful study. We had to consider:

- What was our basic problem?
- What accuracy was required?
- What type of analyzers were available?
- Were they adaptable to our situation?
- What sort of maintenance was likely to be needed?

Like most other refineries, we have final tanks where the gasoline components are blended and tested before shipping. The motor gasoline is pressured with butane by mixing through circulating pumps and jetting back into the blending tank. Tank samples were taken during the blending operation to check the vapor pressure of the gasoline.

Time was wasted waiting for laboratory results. Also, tanks had to be circulated longer than necessary to insure that the butane and gasoline were uniformly mixed before the final sampling. This tedious method of trial and error took some 7 to 8 hours. Overpressurizing would mean complete reworking of the tank requiring an additional 5 to 6 hours.

This blending method had three major possibilities for error: (1) poor sampling, (2) insufficient mixing, and (3) inaccurate laboratory analyses. All of these seriously affected the blending process at one time or another.

Theoretical considerations . . . The traditional method for measuring vapor pressure of petroleum products is the "Standard Reid Test" as described in the ASTM code. This is a time-tested laboratory method for which a very careful procedure is used. The ASTM Reid test has a reproducibility of ±0.2 psi. However, serious errors can result if the tester deviates from the standard procedure, or if the bomb is not in first-class condition.

The Reid test bomb consists of a gasoline chamber, an air chamber, and an accurate pressure gage. Volume of the vapor chamber is four times that of the liquid portion. The bomb is placed in a water bath at 100° F. and the liquid-vapor allowed to come to equilibrium at that temperature. Under test conditions, a portion of the more volatile hydrocarbons in the gasoline are vaporized.

The result is that the Reid vapor pressure is somewhat lower than the actual vapor pressure of the gasoline. The Reid vapor pressure is an empirical number. In general, the Reid vapor pressure for motor gasolines is from 5 to 9% lower than the actual vapor pressure. An average of 7% is widely used as a rough conversion.

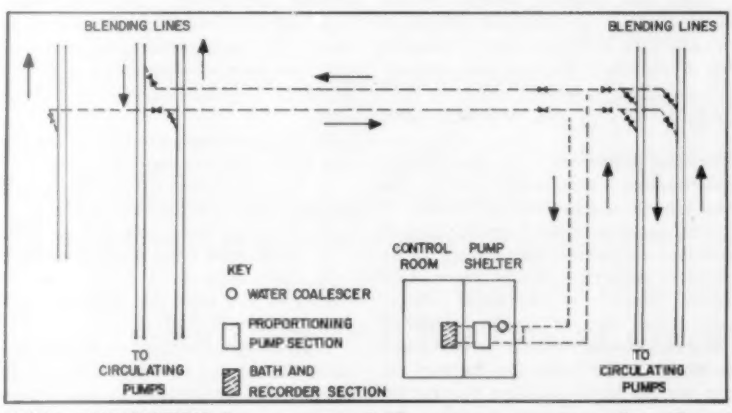
A useful continuous analyzer must duplicate closely the Reid test conditions to get similar results. Precision Scientific Co. manufactures an analyzer which closely duplicates the operating principles of the Reid test.

Operation

A schematic flow diagram of the "Automatic Reid" is shown in Fig. 1. The instrument takes a sample of gasoline from a slip stream of the circulating pump. The sample is filtered and passes into the inlet of a proportioning pump. This pump is regulated to pump precisely 60 ± 0.1 cc. per minute. A line pressure gage is mounted on the instrument panel to indicate at a glance if the gasoline sample is circulating in the system. Gasoline flows through a check valve and into a constant temperature bath. This bath heats the sample to 150° ± 0.1° F.

The sample is pumped to the vaporizing chamber, where a float maintains a constant liquid level. The outlet line goes to the opposite side of the proportioning pump. In the vapor-pressure chamber the gasoline is vaporized and exerts its vapor pressure at 150° F. Pressure is directly indicated on the vapor-pressure gage. This pressure could be correlated roughly to Reid vapor pressure, but would be influenced by atmospheric pressure and temperature changes.

Atmospheric changes can be significant when measuring with ±0.1 psi. In addition, no matter how elaborate



PIPING INSTALLATION for automatic Reid vapor pressure recorder. Fig. 4.

"Analyzer's accuracy is ±0.1 psi. for the range investigated . . . the standard Reid ASTM test reproducibility is ±0.2 psi."

a constant temperature bath system is provided, experience with other analyzers has shown there will be some slight temperature variations. This analyzer is designed to overcome both of these objections.

The instrument has a pressure and temperature compensator. An acetone bulb is located near the gasoline chamber in the oil bath. Acetone has a vapor pressure-temperature curve similar to gasoline stocks. The analyzer measures a differential pressure between the gasoline and the acetone. The pressure differential is independent of atmospheric pressure and also of small temperature variations.

Vent system . . . In addition, the chamber has a capillary vent. This vent insures that the vapor in the vapor space is free of noncondensable gases. These gases would accumulate if an outlet was not provided. The vent is so sized that at a 60 cc. per minute gasoline rate, the liquid and vapor in the chamber are in equilibrium.

The instrument is relatively simple, and its controls are not critical. Rate, pressure, or temperature can vary slightly without affecting instrument accuracy. Readings are accurate with temperature variations of ±2° F. and rate variations of ±1 cc. per minute.

Construction of the equipment is shown in Fig. 2.

The instrument is built in two sections. The lower section of the instrument was put outside our pump-house station. This is a safety precaution to keep gasoline pumps out of enclosed areas. The oil bath, vaporizing chamber, and gages are in the upper section. We have installed them inside the pump-house station. The vent capillary is piped out of the room. As an additional safety precaution, we have a small steam jet creating a slight vacuum on the whole upper structure. This keeps the hydrocarbons out of the closed room.

Calibration . . . The actual calibration of the analyzer was very simple. We obtained gasoline samples with known Reid vapor pressures and processed them through the instrument. Plotting the recorded differential pressures versus the known Reid vapor pressure, we obtained the correlation shown on Fig. 3.

The operating personnel were asked to record instrument readings versus final Reid vapor pressures for the blends. After 2 months, we had approximately 100 points which fell very close to this line. These extra points not only checked our calibration, but established the operating personnel's confidence in the equipment most convincingly.

From a statistical analysis of these data, we found the analyzer's accuracy is ±0.1 psi. for the range investigated. By comparison, the standard Reid ASTM test reproducibility is ±0.2 psi.

Sampling system . . . No process analyzer can do a satisfactory job with a nonrepresentative sample. In fact, many people say more attention should be given to the sampling system than to the analyzer. Proper sampling means:

1. Obtaining a representative sample.
2. Transporting it to the analyzer with minimum time lag.
3. Acting upon it while in transit to put it in a state suitable for analysis.

The sampling system for the continuous Reid is shown in Fig. 4. A fairly large slip stream is taken from the outlet of the circulating pumps and back to the pump inlet. From this stream, we take another slip stream to the analyzer. The volume of this second slip stream is controlled closely by the instrument's proportioning pump.

Ahead of this pump, we have installed a water coalescer. Water in the gasoline stream would seriously affect the Reid-vapor-pressure reading. The coalescer is a small cylinder about 1 ft. high packed with fiber glass. Once a week the blender bleeds the trapped water out.

With this sampling system, we are assured of a representative sample to the analyzer with less than 2 minutes lag in the line. The gasoline streams are switched manually since we normally blend only one tank at a time.

Blending procedure . . . Blending to specification vapor pressure with normal butane is now done as follows:

The gasoline in the blending tank is sampled and tested. Depending on its physical properties, the optimum Reid vapor pressure is calculated. Meanwhile, the pumper starts circulating the gasoline and injecting the normal butane. As he adds the butane, he can see the vapor-pressure rise on the analyzer. He continues to watch the pressure rise until the vapor pressure is slightly below his target. He then cuts the butane and circulates until the vapor pressure is constant.

At that time, he not only knows the vapor pressure of his gasoline blend, but also exactly when his tank was uniformly blended. The procedure takes about 3 to 4 hours. This is about half the time previously needed.

Operating personnel have accepted the automatic Reid readings as a tremendous help in their operations. They will now challenge a laboratory vapor-pressure result when it differs from the analyzer indication.

Maintenance . . . The automatic Reid-vapor-pressure analyzer must be kept in proper operating conditions. A strict maintenance schedule was recommended and is closely followed. We studied the manufacturer's recommendations closely, and then wrote a simple but rigid maintenance schedule.

The responsibility for maintaining this schedule was left up to the operating and instrument personnel. The blender makes a daily check on:

1. Oil-bath temperature.
2. Filter.
3. Vent capillaries.

Any discrepancies are reported to the instrument repair man for correction.

The instrument man checks various items at specified times. The most important item checked is the instrument flow rate of 60 cc. per minute. This is checked weekly.

With this maintenance procedure, we have had practically no operating trouble. Average maintenance, including checking, has been less than 1 hour per week.

Payout justification . . . What have been the actual benefits obtained from use of the analyzer? A comparison of the first year of operations with the previous 2 years showed as following:

1. A significant amount of butane was upgraded to motor gasoline.
2. Closer control of product vapor pressure was maintained.
3. Blending time was cut in half.
4. Tank reworking was eliminated.
5. Laboratory Reid vapor tests reduced by 1½ tests per blend or over 100 per month.

Upgrading of butane to motor gasoline was by far the largest economic benefit and amounted to more than all the other combined.

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75 hp Wagner Type EP Motors drive the four 22-foot fans in this St. Joseph Light and Power Company's cooling tower.

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Driving 22-foot cooling tower fans is a job for rugged motors—motors that must operate without attention month after month, completely exposed to all kinds of weather and to constant high humidity, the number one cause of motor failure in cooling tower applications.

The Wagner Type EP Motors used on this tower meet these requirements. All vital parts are totally-enclosed for extra protection against fumes, dust and moisture . . . and the frames, endplates and conduit box are made of heavy cast iron for extra protection against high humidity and corrosion.

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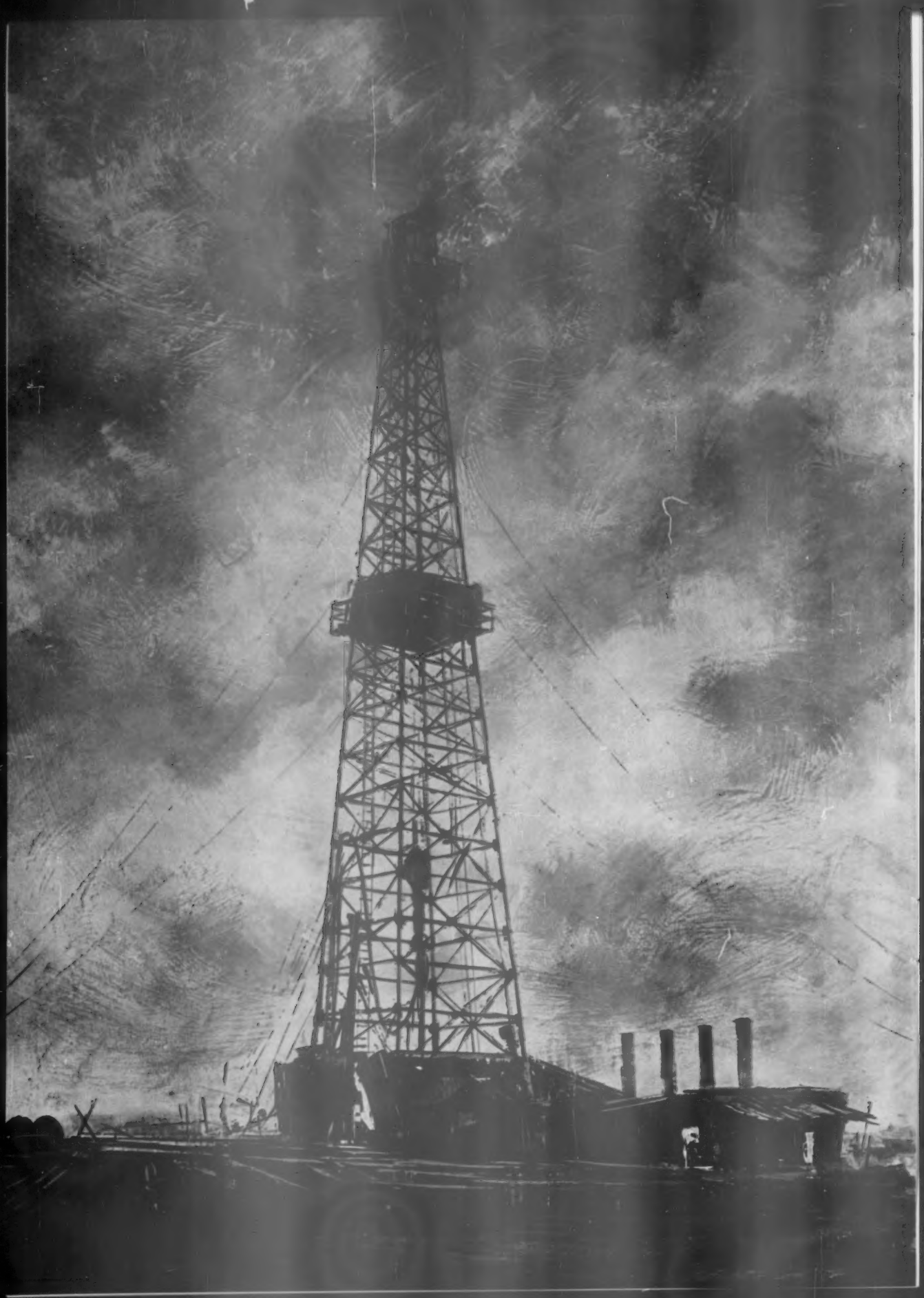

Fourth in a Series — "Evolution of the Rock Bit"

NEW ERA IN DRILLING PROGRESS INTRODUCED

BY HUGHES "TRI-CONE" BITS

THE DAWN of a new era in rock bit designing and the first long step toward the development of modern drilling techniques came, in 1933, with the introduction of the Hughes unit-type three-cone bits, equipped with self-cleaning cones. Self-cleaning cones were first proved on the Simplex bit in 1925.

The three points of rolling contact on bottom made the three-cone bit (later identified as "Tri-Cone") smoother running. The 50% more gage surface, fortified with tungsten carbide, made it possible for the three-cone bit to better hold the gage of the hole.

The unit-type "Tri-Cone" design triggered a rapid series of developments. It permitted Hughes engineers to concentrate on designing cutting structures to drill specific formations. And during the mid-30's, Hughes brought out its "tailor-made" bits — "a bit for every formation."

Instead of an all-purpose bit (which the first "Tri-Cone" bit had been), the "tailor-made" bits included the "S" bit for soft formations; the "OSQ" for formations on the softer side of medium hard; the "D" for medium hard formations; the "W" for hard formations, and the "HR" for extremely hard, abrasive formations. The unit two-cone bit was used primarily to dig soft, broken formations, and, today—greatly modified in design—is still used primarily for this purpose.

For their time, the "tailor-made" bits were a sensation. They tripled the rate of penetration and doubled the footage drilled per bit. Their success gave added emphasis to research and spurred the efforts of Hughes engineers. Each new advance opened the door to still further improvements, and step by step led to the present-day, high-performance, highly specialized Hughes bits.

West Texas, with its high percentage of hard and extremely hard abrasive formations, was a proving ground for the first "Tri-Cone" bits. As an example, take Gulf's J. T. McElroy 103—a record deep well for its time—12,786 feet. It took 26 months—March 21, 1933 to May 25, 1935—and 965 bits to drill this well. The lessons learned in those 26 months helped to speed the development of tailor-made "Tri-Cone" bits. In the illustration at the left, the artist has pictured the Gulf McElroy as it appeared while drilling in 1935. Large reproductions, suitable for framing, are available for the asking. Write: Adv. Dept., Hughes Tool Co., P. O. Box 2539, Houston, Texas.

HUGHES TOOL COMPANY

"TAILOR-MADE" BITS OF THE 30'S — "A BIT FOR EVERY FORMATION"

Type "S"

Type "D"

Type "OSQ"

Type "W"

Type "HR"

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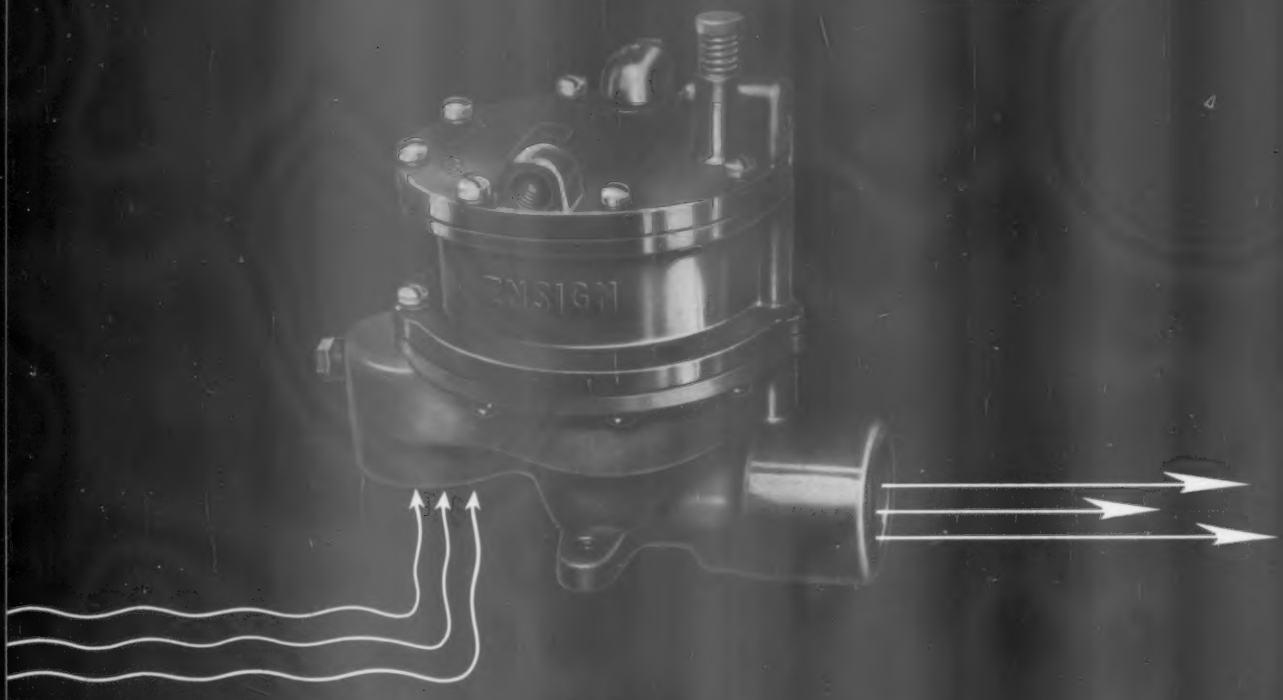

The most expensive carburetion equipment you can own is cheap equipment that won't work! And Ensign is convinced that you are more interested in performance than price.

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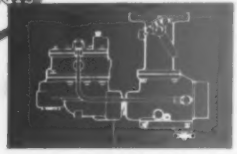
Ensign equipment *works.*

This Ensign Model "B" Regulator, for example, accurately meters the supply of butane or natural gas to the carburetor—shuts off supply when demand ceases. It works cleanly and efficiently—and automatically—to regulate lean or rich mixtures required for continuous power... for intermittent heavy or light loads...or from idle to fast acceleration. There is nothing to match it for smooth, economical fuel metering—metering that works under every operating condition.

Ensign carburetion is on America's finest gas engines. For carburetion that works, insist on Ensign...*accept nothing less!*



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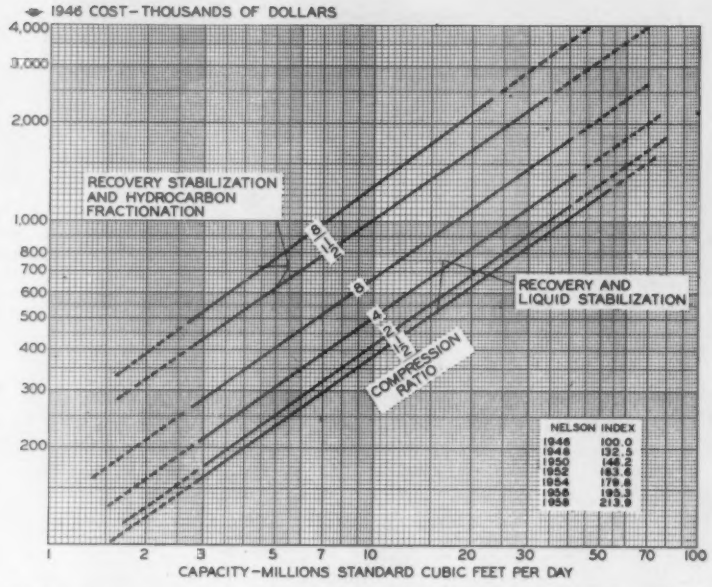

COST of gas-recovery plants as a function of compression ratio. Fig. 1.

What's the cost of refinery gas-recovery plants?

In your Cost Series you do not show the cost of gas-recovery plants. Have you information on this subject? S. Wm. F.

Scarcely any information has been published on the cost of gas-recovery installations probably because such great variations are possible, not only in the pressures employed but even in the completeness of the installation or completeness of the recovery or subsequent separation of the absorbed components. These variables result in a wide range of costs.

Pressure or compression ratio is a major variable and it has been retained on Fig. 1. Somewhat the following absorber pressures are contemplated:

Compression ratio	Pressures
1.5	90/60
	120/80
2.0	90/45
	120/60
	220/110
4.0	100/25
	160/40
	240/60
8.0	200/25
	240/30
	320/40

The four lower lines of Fig. 1 contemplate only the recovery of the gases and stabilization of the recovered liquid. This may involve absorption by an absorption oil or absorption by heavy gasoline. It involves stripping of the rich oil with steam, or distillation of the gasoline to recover the lean or high-boiling gasoline. It also includes stabilization of the recovered liquid. Absorption of propane amounts to about 45% and when recovering 34 to 60%, the cost of the installation ranges by about plus or minus 12% of the costs shown in the figure. In addition, the costs also represent with fair accuracy the cost of a high-pressure combination absorber-stabilizer operating on cracked gasoline and cracked gases, followed by a small absorber using cycle oil (which returns to the cracking-plant fractionator). All of these systems cost approximately the same.

The upper two lines contemplate the same operations as those of the four lower lines but in addition the stabilization of the entire plant gasoline and the separation of propane, isobutane, butanes, and isopentane from each other in fractionators.

The costs shown here are somewhat lower than the costs of natural gasoline plants published in the news literature (see Costimating No. 28, OGJ, April 15, 1957). Possibly the refinery gas-recovery systems are cheaper because refinery gases are richer and because many auxiliary services (water, steam, offices, etc.) are already available in refineries.

The costs of Fig. 1 may be brought to date by means of the Nelson Refinery Construction Cost Index which is published in the first issue each month of The Oil and Gas Journal.

Cost of small carbon-black plant

About how much would a 1-ton per day carbon-black plant cost? We have in mind to use salvage equipment insofar as possible.—K.A.H.

Although one is tempted to build small plants when little capital is available, the cost of such plants is usually prohibitive. This department has no costs on such small plants nor will information become available because such plants are not economically feasible in the U. S. or in most world areas. However, as an indication of the effect of size on cost, note the following approximate installed 1956 costs:

Capacity, tons per day	Cost, dollars per yearly ton
150	$ 1,130
100	1,370
50	1,910
30	2,470
*10	*4,120
*1	*12,340

*No date. Obtained by extrapolation.

Much the same general relationship should apply even though used equipment is employed. Thus, a 1-ton plant would cost almost one-fifth as much as a 30-ton plant. Such a burden of capitalization might be satisfactory under some circumstances, but the extremely large operating cost of such a small plant would ordinarily be an unsurmountable obstacle.

Capital is relatively easy to obtain if only the business proposition is a truly good one. In this instance the small size of the plant may indicate that the business proposition is not sound.

The Permian Basin is consistently a newsmaking area for the oil-producing industry. Operators here find Sandfrac, one of the oil-base fracturing services developed by Dowell, a reliable stimulation treatment.

MAKE YOUR WELLS WORTH MORE

Get Dowell's experience with oil-base fracturing

More wells are fractured with oil-base fluids than with all other fluids combined. Acid-base and water-base fluids give outstanding results in many areas, but there are good reasons why the use of oil-base fracturing is so widespread.

First, oil-base frac fluid is proved. The results of thousands of oil-frac treatments provide both operators and Dowell with extensive performance data. In many instances these records are extra assurance of trouble-free jobs and predictable results.

If well conditions are not known in detail, oil-base fluids can be used with maximum safety because compatibility problems are at a minimum. Oil-base fluids—particularly lease crude—cause relatively few problems from emulsions, silicate swelling, or other blocking.

Second, oil is convenient. Lease crude is readily available in nearly all fields, and refined oils may be more readily available than water in some instances. As a result, hauling problems are at a minimum.

Third, oil is economical. Most, if not all, of the gross fluid cost is recovered from the purchaser of the well's production. In most cases, the fracturing fluid will not alter the gravity of produced oil enough to change the posted price.

Also, oil-base fluids require a minimum of addition agents to prevent emulsions or silicate swelling. As a result, chemical costs are kept at a minimum.

You get other important advantages when you specify *Dowell* oil-base fracturing. Dowell has had wide experience in the use of all kinds of oil, ranging from high gravity diesel fuel and kerosene to low gravity crude. They have proved chemicals available to modify the oils if necessary.

For example, sand-falling rate can be tailored to the job. In some instances Dowell has compounded fluids to carry over six pounds of sand per gallon, and to hold this sand in suspension while fracturing extremely tight formations at low injection rates down tubing.

Fluid loss can also be materially reduced if desired. Dowell regularly uses a number of fluid loss additives—each especially effective under certain conditions. Your Dowell engineer can help you select the one best suited to your problem.

Many oil-base fracturing fluids compounded by Dowell feature exceptionally low friction losses. The modified oils used in Petrojel* and Cellufrac* are outstanding in this respect. This makes possible unusually high injection rates considering casing size, well depth and available hydraulic horsepower.

While it is true that oil-base fracturing fluids are most popular, *your* well may respond better to another type of Dowell treatment. To be sure, call the Dowell engineer nearest you. There are more than 165 Dowell stations and offices in the United States, Canada, Venezuela and Argentina. Or write Dowell, Tulsa 1, Oklahoma.

Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Some of many well conditions that make Dowell oil-base fracturing profitable

If your pay is water-sensitive —
— an oil-base fracturing fluid may be indicated. Water-base or acid-base fluids may not be acceptable even though other characteristics of these fluids are attractive. Dowell offers a wide choice of oils—both modified and unmodified—to use in water-sensitive formations.

If water disposal is a problem —
— use an oil-base fracturing fluid. You can usually sell the fracturing fluid right along with produced oil. You regain much—if not all—of the fluid cost in addition to solving the problem of disposing of contaminated water or spent acid.

If you have a low-solubility pay —
— an oil-base fracturing fluid could be best for you. You may not need the limestone-dissolving qualities of acid-base fracturing fluids. Furthermore, emulsion and silicate swelling problems are held to a minimum. Petrojel, Cellufrac or Petrofrac*, using modified oil to reduce sand-falling rate, are helpful here. In some cases, the use of two or more sizes of sand may result in greater increases and more sustained production.

If you are producing a high-paraffin oil —
— use a high-gravity oil for fracturing, and keep paraffin problems at a minimum. Under certain conditions, Paraffin Solvent may be included as part of the treatment.

If you are producing an old well —
— complete information on formation characteristics may not be available. For safety, many operators specify Sandfrac*, using either refined oil or lease crude. Since most of these wells have been stimulated previously, large, high-injection-rate treatments are often required to give satisfactory production increases.

If you have a thin, marginal pay —
— you may want to keep stimulation costs at an absolute minimum. In many such wells, operators have selected Sandfrac using lease crude. Volumes and injection rates are kept low to minimize equipment costs. Many times, the needed crude oil is available on the lease. Also the fluid cost is recovered when well production is sold.

If you have any questions —
— call the Dowell engineer nearest you. He has full knowledge of Dowell's wide variety of fracturing services, using oil-base, acid-base and water-base fluids. His records of local conditions, as well as the experience of the entire Dowell organization, will be of great help in selecting the proper treatment.

*DOWELL SERVICE MARK

NEW "FRACTURING GUIDE" Developed and now in use by Dowell engineers. This revolutionary new system has increased the success ratio of fracturing treatments by more than 50%. Ask your Dowell representative to engineer your next treatment using the "Guide." This extra service costs you nothing.

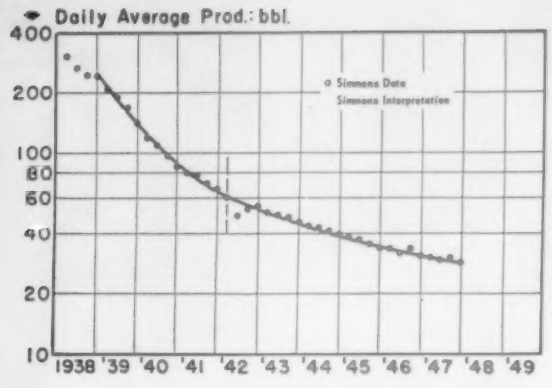

Fig. 1

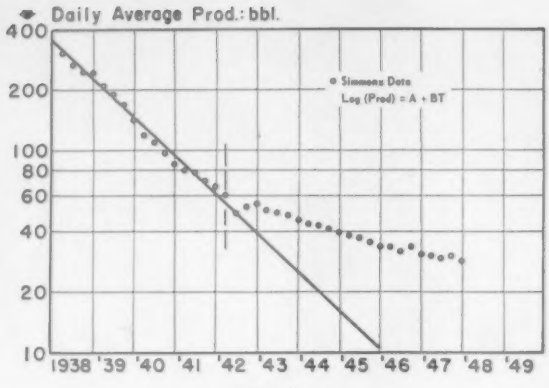

Fig. 2

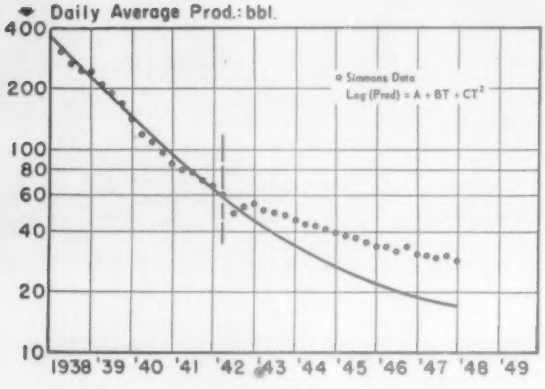

Fig. 3

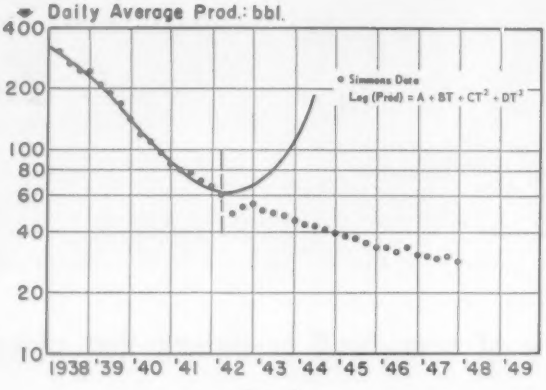

Fig. 4

How to interpret and analyze water-flood curtailment data

Statistical methods help to provide a solution to extrapolation problems

BY C. F. WEINAUG
Chairman, Department of Petroleum Engineering, University of Kansas

IN THE STUDY of field data, a number of difficulties arise. First, under normal operating conditions, several factors vary simultaneously and results cannot be assigned easily to any one of the variables. In those rare cases in the production of oil where only one factor is changed, the history before the change must be used to determine what might have happened if the change had not been made.

Presented at the Salt Lake City meeting of the subcommittee on study of effects of curtailment of production from water-flood projects of the Secondary Recovery and Pressure Maintenance Committee of IOCC.

The extrapolation of field data usually gives rise to several interpretations since the field data do not form a pattern through which one, and only one, line can be drawn. In these cases there is a scattering of points on each side of the drawn line. This scattering must be the result of random variations in operations. If the variations are systematic, they will cloud, if not obscure, the effects of the variable being studied.

Another problem in extrapolating data concerns the form of equation to be used for the process. If the process being studied can be described by a rigorous equation, data can generally be interpolated and extrapolated over long ranges with a high degree of confidence. However, this assurance is not possible if an empirical method is used to extrapolate data. A relevant factor may be so minute during the interval covered by the data that its effect would not be measurable. Yet event-

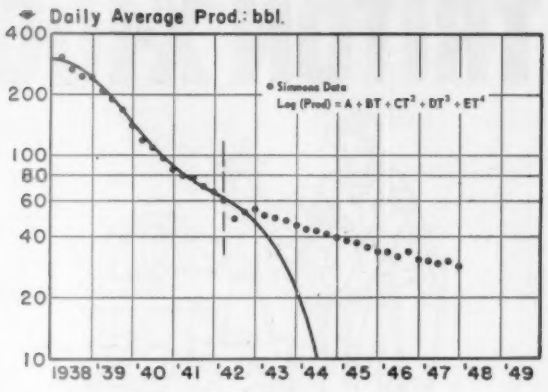

Fig. 5

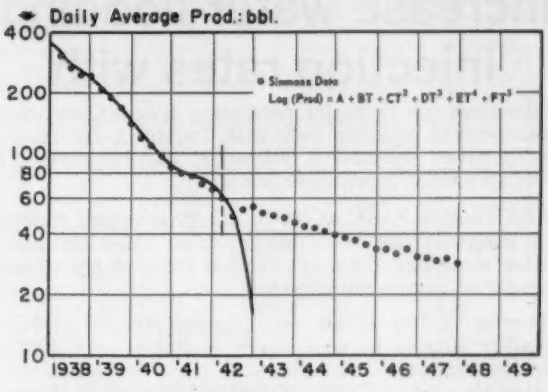

Fig. 6

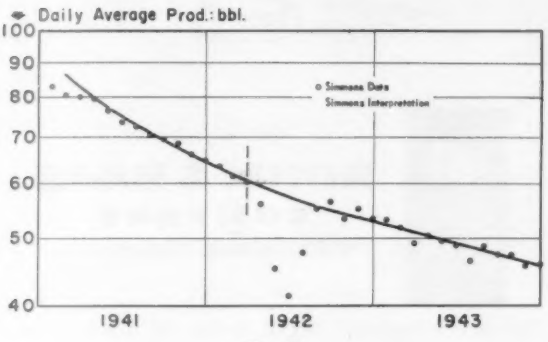

Fig. 7

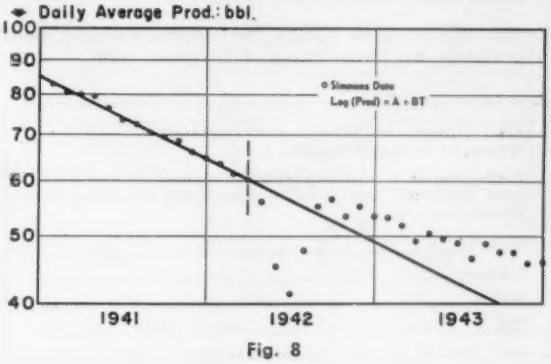

Fig. 8

ually this same factor might control the results obtained. These circumstances account for the failures of many predictions.

The economists' failure to predict future economic conditions by extrapolating present trends is a notable example of this type of problem. The problem of detecting factors which might control future results is further compounded by day-to-day as well as month-to-month random variations in oil operations.

In the case where variations are random except for one, there are statistical methods for determining the so-called "best fit" line that can be passed through the data for any form desired. Thus, once the form of the curve is decided, a mathematical process, the method of least squares, can be devised which will pass a line of this form through the data so that the sum of the squares of the differences between data and line is a minimum. This procedure results in one, and only one, line. This eliminates effects of preconceived ideas which interfere with accurate evaluations and are difficult for an individual to ignore.

A. C. Simmons, in presenting a number of examples of water-flood decline, pointed out the difficulty of obtaining field data by stating: "Fig. 1 is considered a typical decline curve in the Bradford area. This includes quarterly data with semilogarithmic plotting and the smooth curve drawn through these points appears to reflect the decline trend on this property. This property was operated under constant injection pressures from 1939 through 1947, except for a period in 1942 when injection pressures were reduced sharply due to a mechanical breakdown. Two pumps were operating in a pressure plant and one was seriously damaged and replacement was difficult to obtain during the war period.

"Fig 7 is an enlargement of the years 1941, 1942, and 1943 of the curve shown in Fig. 1. This represents monthly data and shows clearly the changing rate of oil production for the period April through August 1942.

"It would appear from the average curve, that no substantial makeup in oil occurred as the result of this loss, or deferment. It is perfectly understandable that with reduced injection of water, one would expect a reduced oil-output rate but it is difficult to visualize the time factor in the total recovery as the operator would expect the production to have followed the smooth curve in the case of no interruption."

This paper covers the analysis of the original data of this example by standard statistical procedures discussed above.

Production data were punched into cards and coefficients for several equations were computed using an IBM 650 computer, applying the method of least squares. First, the straight line on a semilogarithmic plot was determined for Fig. 1 data obtained before the mechanical breakdown. This curve and the original data are plotted on Fig. 2. The extrapolation of this line would indicate an improvement in recovery due to the curtailment.

The data were also used to determine curves which have higher-order functions of time. These curves and their mathematical forms are presented in Figs. 3, 4, 5, and 6.

Both curves in Figs. 2 and 3 give about the same results. These figures, as well as Simmons' Fig. 1, also point out some distinct characteristics of the data itself. The points in 1938 and 1940 all fall below, while most of 1939 and 1941 data are above the curves. This would indicate that there was some sort of cyclic nature to the curve in addition

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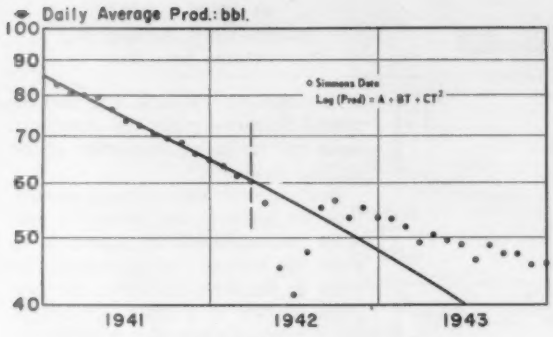

Fig. 9

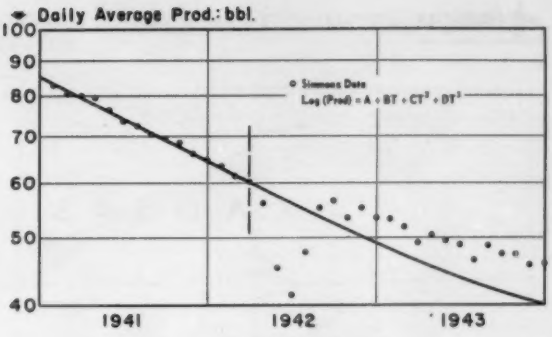

Fig. 10

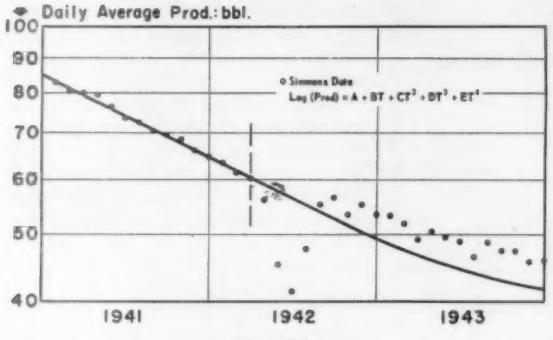

Fig. 11

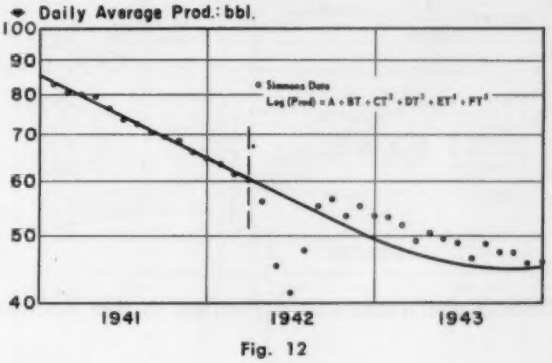

Fig. 12

to the general decline. The higher-order functions used in the equations for Figs. 4, 5, and 6 result in a curve which attempts to follow the cycles. In following the cyclic nature of the data, the third-order polynomial used as a basis for Fig. 4 gives an improved fit for the data. However, the extrapolation gives an entirely erroneous result.

In a like manner, the fourth and fifth-order polynomials used as a basis for Figs. 5 and 6 give a better fit of the data but still give results that are not entirely reasonable. In any case, the variations in the data itself make it difficult to extrapolate to any greater degree than what might be a possible average of these variations such as shown in Fig. 3.

A comparison of curves in Figs. 2 and 3 shows that the curve in Fig. 3 actually approximates the general trend of the data better than the curve in Fig. 1. This is especially true since extending the curve in Fig. 1 back into 1938 yields unrealistic results. From the above considerations, only two possible conclusions can be reached. First is that variations in the data itself make an interpretation impossible, or second, the curtailment in 1942 due to mechanical failure on this water flood increased ultimate recovery.

The information in Fig. 7 was treated in the same manner as data which covered a longer span of time. All mathematical forms used in this case resulted in almost identical curves as shown in Figs. 8 through 12. The close agreement would indicate that these data could be extrapolated on this basis into the middle of 1943 with some degree of assurance. Since these extrapolations all fall well below actual production obtained when the high rate was restored, the ultimate recovery of oil from this project appears to have been improved instead of decreased by the 1942 curtailment.

Reference

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Coming July 27 . . .

MIDYEAR REVIEW AND FORECAST

NEXT WEEK, the Journal will present its special, 40-page Midyear Report on 1959 activity, with special emphasis on what to expect the rest of the year.

Watch for significant feature articles and statistical reports on these topics:

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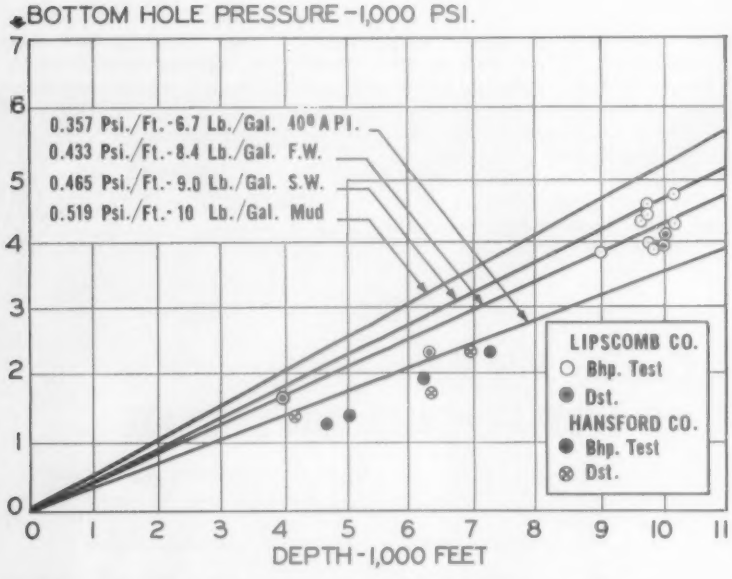
- The supply and demand picture
- Analysis of Examiner Zwerdling's decision in the Phillips gas case
- Domestic and foreign production
- Home-heating fuel consumption
- Imports and exports
- Product prices and price trends

BY JOHN R. ECKEL
Humble Oil & Refining Co.,
Wichita Falls, Tex.

Subnormal reservoir pressures in the Anadarko basin . . .



yield to bottom-hole pressures like these, causing loss of mud. Drillers have learned a lot about . . .

Lost circulation

—and how to prevent it

SUBNORMAL PRESSURES and incipient fractures make the Anadarko basin bad for losing circulation of the drilling fluid.

Best cure for lost returns is prevention. By applying the preventive program outlined here, it is possible to make big savings. As an example, in 1958 in the Hansford field, the program resulted in a sharp decrease in the number of cases of lost returns as well as in the problem of sloughing shale. As a result, total rig time was cut 8.7 days, or 25.2%; mud costs were cut 53.5% on a cost per foot drilled basis. Table 1 outlines these savings.

All procedures in the program to prevent lost circulation are intended to reduce the pressures in the well which can cause fracturing and mud flow to the formation. In this aim, the four most important points are:

1. Hole size.
2. Mud properties.
3. Pipe handling.
4. Breaking circulation.

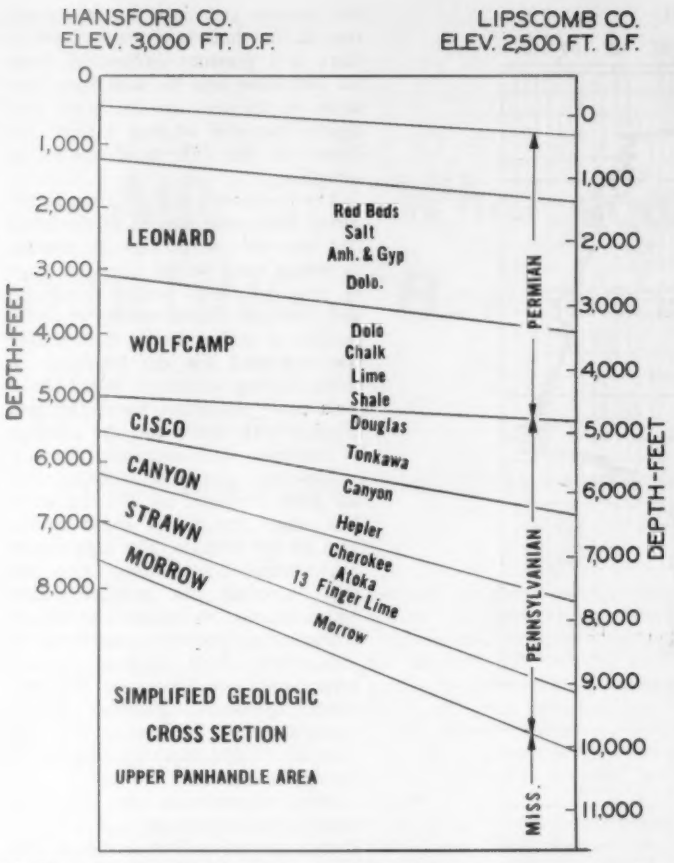
Here are why these items are important:

. . . **Hole size.** Drilling 7⅞-in. hole with 4½-in. drill pipe leaves about one-third more annular clearance than 6¾-in. hole drilled with 3½-in. pipe. With the larger hole size, the annular pressure drops are lower and the effect of the hole restrictions is less. Better bits and improved hydraulics are extra benefits of the larger hole and these can cut drilling time.

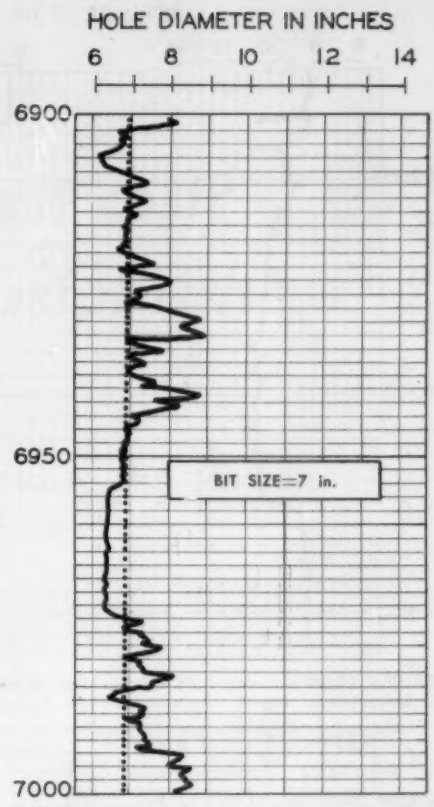
. . . **Mud properties.** Reducing the viscosity of the drilling fluid reduces pumping pressures and the surge pressures resulting from pipe handling. The better flow properties of the fluid result in better cleaning of the hole. And by using desanders to maintain mud solids at a minimum, drilling rate is further increased. While low gels reduce fillup during trips, they actually cost less because it is harder to maintain high viscosity and "0-0" gels at the same time.

. . . . **Pipe handling.** Too few people understand what great pressures are caused by moving pipe rapidly in a close-clearance hole full of high-viscosity fluid. These pressures approach fracturing pressures in magnitude and often have the same result. If pipe-dropping speed is limited to 1 minute per stand and if pipe "chasing" is stopped, this source of pressure is al-

Article is from a paper entitled, "Lost Circulation in the Anadarko Basin", presented at 1959 spring meeting, API Division of Production's Mid-Continent District, Amarillo.



SCARCITY OF WELLS drilled in the Anadarko basin—only one well or less per square mile—correlation of formations between wells is harder than in normal oil development. Enough wells have been drilled, however, to form a general picture.



MICROCALIPER LOG of drilling in Hansford County, Texas. Annular clearance is one of the factors which affect increase or decrease of pressure in the hole.

most eliminated. It has been particularly hard to slow down pipe-handling speeds. This is because it violates the tradition that a fast trip is the mark of a good crew. The hole should be kept full on trips out of the hole to minimize sloughing.

. . . Breaking circulation. Circulation should be broken every 2,500 or 3,000 ft. while going into the hole. This cuts the pressure required to break circulation when the bit gets to bottom. Rotating the pipe to break gels and bring the pump up to speed slowly also cuts the pressure on the formation.

Where circulation is lost . . . The Anadarko basin covers portions of the Texas Panhandle, Kansas, and Oklahoma. For several years it has been one of the most active drilling areas of the country, particularly on the western flank where there has been intense development of the Morrow sands. Production from the Morrow has been primarily gas, with 640-acre spacing.

With only one well or less per square mile, the correlation of formations between wells is harder than in normal oil development. Enough wells have been drilled, however, to form a general picture. Bottom-hole pressures in permeable zones are generally subnormal, but the gradients increase with depth and movement towards the east. There is a fairly thick salt section in the Leonard. Above the Mississippian, the deepest zone now drilled, there are several massive shale sections, dolomite, and lime as well as several potential pay zones. Many of the formations are fractured, particularly in the Wolfcamp.

Lost returns have been a common and expensive problem over the area. The general conditions for lost circulation anywhere, including Anadarko, are these: (1) There must be a flow and a differential pressure in the direction of flow for mud to be lost into the formation, and (2) for a mud with normal solids distribution, there must be a permeability of 300 darcies at a differential of 250 psi. for mud to flow in quantity.

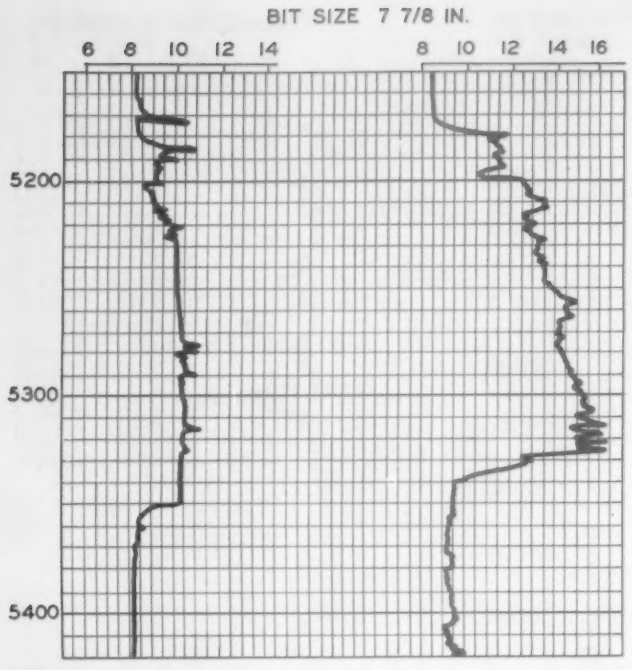
No formation permeabilities as great as 300 darcies are known in the area. For example, average of the Morrow sands is about 10.1 darcy. Permeability large enough does exist in fractures. Inasmuch as many of the formations in the basin contain incipient fractures, it appears certain that these fractures are opened up and mud is lost to them.

Why it is lost . . . The pressure which causes the flow of the mud from the

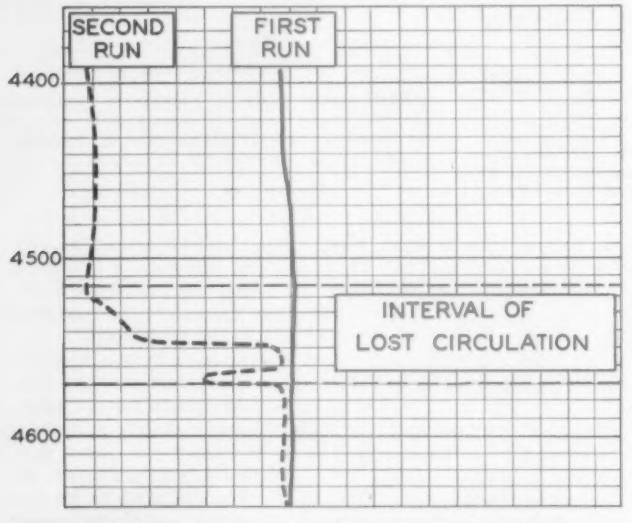
TABLE 1—EFFECT OF HOLE SIZE AND SPECIAL PROCEDURES ON DRILLING TIME AND MUD COST HANSFORD COUNTY, TEXAS—1958

Hole size (in.)	Number of wells	Average depth (ft.)	Average big-rig (days)	Mud cost* 7-well Average	Mud cost* Per well range
6¾	7	7,590	34.5	100	201 48 79
7⅞	7	7,520	25.8	47	33

*As a percentage of 6¾-in. average cost.



CALIPER LOGS showing hole enlargement in two wells in Lipscomb County, Texas. Fig. 5.



TEMPERATURE LOG shows location of loss zone, Hansford field, Hansford County, Texas. Fig. 6.

well bore is the sum of pressures from several sources: hydrostatic weight of the fluid, including the additional effective weight resulting from the cuttings and cavings in the mud; surge pressures caused by the velocity and acceleration effects of pipe handling;[2] and finally, the pressure in the annulus required to circulate the mud. This annular pressure is a function of mud properties, rate of flow, and annular clearance. It increases with viscosity and rate of flow and it also increases as clearance decreases. Oversize pipe protectors or filter-cake buildup (Fig. 4) cause large increases in this pressure, whereas drilling a larger hole may decrease it.

Shale sloughing has been another widespread problem in the basin. It is mentioned here since it is related to lost returns. The original material from the caved section (Fig. 5), as well as the cuttings subsequently trapped in the enlarged section, periodically slough in. This causes bridges and temporary increases in effective mud weight. Lighter-than-normal mud weights in the range of from 8 to 9 lb. per gal. have been used to combat lost returns; and since the pore pressure in the shale is probably normal, there is a pressure differential from the formation into the well bore. The shales in the area are also weak and highly fractured so that a slight increase in this differential results in sloughing.

The traditional mud program in the Texas Panhandle portion of the basin has been the use of high oil content to reduce mud weight, large amounts of roughage, high funnel viscosities, and 0-0 gels. These muds were expensive to maintain; the shale shaker was bypassed for the roughage so solids buildup was rapid. When chemicals could no longer lower the gels, dilution with water and the addition of bentonite were required.

The high viscosities did not solve the shale problem, nor did low water loss, since the deeper shales in the area do not hydrate. The high viscosity increased the swabbing effect and thus increased the pressure differential, causing sloughing; and the increased surge pressures contributed to lost returns. This program did not solve either the shale or the lost-returns problems. Further, drilling rates were low because of the high viscosities,[3] and carrying capacity of the mud system was reduced.[4]

Once returns have been lost, steps must be taken to regain circulation—if it is required. That is, blind drilling can be substituted if sufficient water is available and if the absence of cuttings can be tolerated. If circulation must be regained, the first step is to determine the zone of loss. Temperature surveys have been quite satisfactory for this purpose (Fig. 6). It cannot be assumed that the loss zone is necessarily at bottom. In the case shown in Fig. 6 returns were lost above 4,570 ft. while drilling at 7,224 ft. This particular potential loss zone appears to be general over the upper Panhandle area.

After the zone has been located, good results have been obtained from spotting a heavy slurry of roughage—nut shells and cotton-seed hulls, fiber, etc., across the zone. In extreme cases modified cement with calcium chloride should be considered.

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AIR DRILLING | *What does it cost? How successful is it?*

Here are some clues that might lead to the answers

BY GORDON JACKSON
President, Well Completions, Inc.
Denver

AIR DRILLING does not need to solve all the problems in a particular situation to save money. Nor does it need to be used exclusively in a well. Air drilling should be considered for each and every well for there is a potential saving even if only a portion of the hole can be air drilled.

This article is intended to give those who are considering drilling with air a good yardstick by which to estimate what costs may be and what the chances are for a successful run with air. Well Completions, Inc., has surveyed the 226 wells on which it supervised the air drilling in a recent 18-month period. The figures cited here are taken from those 226 wells and the 419,407 ft. of hole air drilled in those wells.

The average cost per foot for air was $1.37, or $0.92 per foot exclusive of standby charges. Where no water was encountered in the hole, the footage cost sank to $0.77 per foot, or $0.51 plus standby.

Of the 226 total wells, 63% had some degree of water invasion into the hole. However, this water entry was successfully overcome in 76% of the cases where it was found, so that the over-all success ratio for air drilling was 85%.

How survey was made . . . In this analysis, no attempt was made to break down the jobs into types and hardnesses of formations penetrated. The operations extended through six different states with depths ranging from grass roots to over 10,000 ft. These successively drilled wells were assumed to give a general cross-section of the industry's use of air.

Since formation-fluid invasion into the borehole has been the major deterent to successful air drilling, the 226 jobs were divided into three groups for this study:

1. Those which had dry formations throughout, and reached projected depth.
2. Those which encountered wet formations, and reached projected depth in spite of water entry.
3. Those which encountered wet formations and reverted to conventional drilling methods.

Excluded from this survey are all cleanout operations or areated-mud drilled holes. All of the jobs under discussion were begun in anticipation of producing oil or gas. Indeed, many were field-development or extension attempts in known producing areas.

Air only was necessary for jobs in Group 1 where formations were dry throughout. To maintain drilling progress in some of the operations where wet formations were encountered, mist-air or foam-air drilling was used.

Over-all performance . . . As Table 1 shows, only 15% of the total were forced to convert to conventional mud drilling. However, of even greater significance is the information which shows that 48.7% of the air-drilling starts successfully overcame fluid invasion. As short a time as 2 years ago many of these jobs would have had to revert to conventional drilling in order to reach projected depth.

Eighty-two of the jobs—36.3%—were drilled with air alone through dry formations to total depth. Adding the percentages, presently available air-drilling equipment and techniques achieved a success ratio of 85%.

A total of 12,383 hours of drilling time was necessary to make the 419,-

TABLE 1—GROSS AVERAGES

	Successful		Converted,	
	Dry	Wet	wet	All jobs
Number jobs	82	110	34	226
Per cent of total	36.3	48.7	15.0	100.0
Footage drilled	162,540	224,108	32,759	419,407
Rotating hours	3,348.5	6,312.5	2,722.0	12,383
Bits	118	234	70	422
Cost (total)*	$125,037	$278,901	$169,309	$573,247
Standby cost	$41,905	$87,070	$50,315	$179,290

*Includes air-equipment rental and engineering-supervision charges exclusive of fuel and transportation.

TABLE 2—PER JOB AVERAGES—FEET, HOURS, BITS

	192 Successful		34 Converted,	
	82 Dry	110 Wet	34 wet	226 Total
Footage	1,982.2	2,037.3	963.5	1,855.7
Hours	40.8	57.4	80.1	54.8
Bits	1.4	2.1	2.0	1.9

This article is a condensation of an article entitled, "An Analysis of Air Drilling," presented at the 1959 spring meeting of API Division of Production's Pacific Coast District, Los Angeles.

407 ft. of hole covered. The cost of $573,247 includes air-equipment rental and engineering supervision charges and standby time, but is exclusive of fuel and transportation.

In tabulating the data on each job the total cost for air services and the standby charges were recorded. The total standby charges account for approximately 30% of the over-all cost for the 226 operations. Without taking into account the differing equipment requirements or the operator's desire to maintain equipment on standby, the average standby cost per job is $790.

This seems to be a high cost, but there are limits below which this cost for nondrilling, noncirculating time could not be reduced. However, it does represent an average additional cost and would appeal that operator and service company should cooperate to minimize this cost.

Footage, hours, bits . . . Table 2 is the result of averaging certain of the data on Table 1 while still retaining the same wet or dry tabular divisions.

Among the 192 successfully completed jobs, the average footage per job for dry formations penetrated is more than twice the average of those jobs where conversion to mud was necessary.

Rotating hours increased where wetness occurred as did the average bits used per operation. The history of air drilling has shown a decreased penetration rate and lowered bit life in the presence of formation fluids. This progression was thus expected. However, this is the first time that it has been possible to judge the effect of water on bit life in a series of operations where water was successfully overcome and no conversion to mud required.

For the wet group that converted to mud the rotating hours averaged out at 80.1. This figure should actually be higher because 4 of the 34 operations used in the averages did not commence drilling with air, but continued with mud. Since costs were accrued and the respective operators did call air out on the job, use of these operations was considered justified. Were these four not considered, the average footage per job would increase to about 1,100 ft. The average bits used would go from 2.0 to 2.3.

The average footage of the 82 operations where no water was encountered is somewhat less than those where water was encountered. Only two of the operations went deeper than 3,000 ft. under dry conditions. The remainder were shallow wells or a selected interval below surface casing or intermediate strings especially adaptable to air drilling.

The higher average footage drilled under wet conditions includes deep operations where long sections making water in various amounts were drilled through to projected depth.

Thirty-four problems . . . Table 3 consists of performance and cost data derived from both previous tables. It contains the statistical material on those jobs where conversion to mud was necessary due to water entry. In many instances these data tell the story of the determination of operators to use air to solve difficult drilling problems.

The average figure of 467.9 ft. per bit for the 34 jobs represents an average from 70 bits of 11 different sizes. Among these operations which went to mud the range in penetration with air was from 48.3 ft. for the 11-in. bits to 1,065 for one 6¾-in. bit. The range of penetration rates resulted in a 12.0 ft. per hour average and individual rates varied from 3.04 to 28 ft. per hour.

Average air cost per foot for these 34 jobs which had to give up air drilling is four times the average for all wells in the survey. The $5.17 per foot for air may appear expensive. However, this could only be demonstrated by a comparison with previous cost experience in the general area or with the actual costs following return to conventional drilling practice. Reliable data for such a comparison were not available. Actually, on these problem jobs air was able to drill more than 1,000 ft. before conversion became advisable. This may be construed to mean that air at least equaled conventional drilling costs for the same interval before the well was converted to mud.

From the data in these 34 instances, no usable averages could be extracted. Among the reasons for this are the extremes in geographic spread of locations, range in depths and types of formations drilled, bit sizes, air-volume requirements, and the experimental nature of several wells.

Dry and wet successes . . . Table 3 points up some of the benefits of air drilling. Even in the wet wells where water did prevent reaching the objective depth, bit life was higher than could be expected with conventional drilling. Penetration rates in the wet successes averaged 35.5 ft. per hour, 13 ft. per hour slower than the dry successes, but nevertheless outstanding.

Not shown in the table is the $1.04 average cost per foot for air on the 192 successfully completed jobs, involving 386,648 ft. of hole. This cost figure suggests that the potentially large cost savings with air are not appreciably altered where water is encountered and successfully overcome.

Table 4 shows performance and cost for two bit sizes among those used in all of the successful operations. The performance and cost of the 6¼ and 7⅞-in. in dry and wet conditions is contrasted to the over-all averages. Data for the 6¼-in. cover 115,299 ft. of dry formation and 55,997 ft. of wet formation. Similar data for 7⅞-in. bits cover 39,318 ft. of dry formation and 133,619 ft. of wet.

The two sizes of bits had very nearly the same performance. In the two sizes the 6¼-in. seems to be more economical, while the highest cost per foot, wet or dry, is still lower than the over-all average shown in Column 1.

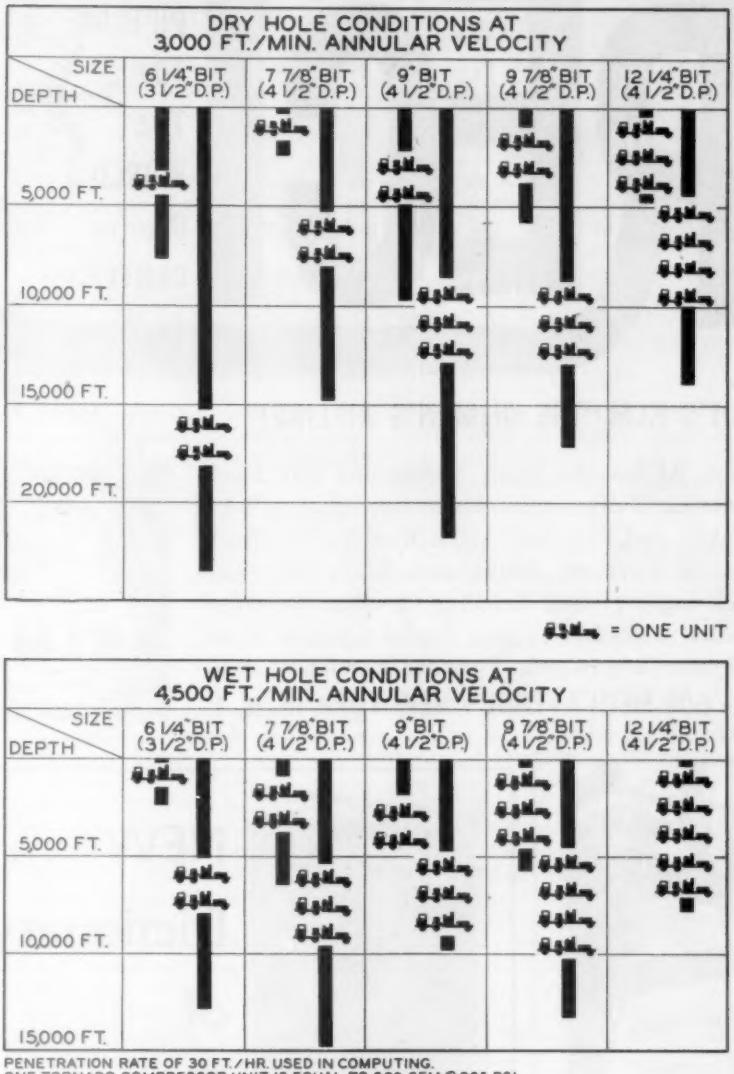
Lower costs may be due to lesser compressor requirements for the smaller sized holes and the ability of being better able to combat water in smaller holes. Table 4 might orient a drilling program toward slimmer air-drilled holes.

TABLE 3—PER JOB AVERAGES FROM TABLES 1 AND 2

	192 Successful		34 Converted,	
	82 Dry	110 Wet	34 wet	226 Total
Feet per bit	1,377.4	957.7	467.9	993.8
Hours per bit	28.3	27.3	38.8	29.3
Penetration rate	48.5	35.5	12.0	33.8
Cost per foot	$0.77	$1.24	$5.17	$1.37
Cost per foot less standby	$0.51	$0.85	$3.64	$0.92

TABLE 4—COMPARISON BETWEEN AVERAGE RESULTS IN ALL SUCCESSFUL WELLS REGARDLESS OF BIT SIZE AND RESULTS OF SLIM HOLE SIZES

	All bit sizes		6¼-in.		7⅞-in.	
	Dry	Wet	Dry	Wet	Dry	Wet
Total bits	118	234	59	32	22	79
Footage per bit	1,377.4	957.7	1,954.0	1,749.9	1,787.0	1,691.3
Hours per bit	28.3	27.3	30.4	34.3	26.5	33.0
Penetration rate	48.5	35.5	64.4	51.0	67.4	51.2
Cost per foot	$0.77	$1.24	$0.54	$0.67	$0.67	$0.80
Cost per foot less standby	$0.51	$0.85	$0.35	$0.45	$0.39	$0.50



PENETRATION RATE OF 30 FT./HR. USED IN COMPUTING.
ONE TORNADO COMPRESSOR UNIT IS EQUAL TO 820 CFM @ 265 PSI. @ 5000 FT. ELEVATION SUPPLYING 1.18 MMCFPD.

AIR COMPRESSOR requirements for air drilling various-sized holes. Fig. 1.

Operators in Rockies drill with air

. . . and bank the savings

BY ROBERT W. SNEED
Well Completions, Inc., Denver

AIR has been used to drill in almost every major Rocky Mountain basin. Some 1,500 wells have been drilled with natural gas in the San Juan basin alone.

As a result of their air-drilling operations, Rocky Mountain operators have made big savings in direct well costs through reductions in rig time, in number of bits used, and in amount of drilling fluid required. Besides its speed of drilling and its lower consumption of bits, air drilling has other qualities:

1. Samples which can be analyzed return to the surface almost immediately.
2. Drilling breaks can be determined as well as with any other drilling fluid.
3. Drilling is only slightly affected by lost-circulation zones, by hard formations, or by damp or "weeping" zones.
4. Water-bearing zones can be accurately located and their flow rate measured.
5. Oil and gas zones can be located precisely. This is especially important in low-pressure formations.
6. Potentially productive formations are measured for flow and pressure without resorting to drill-stem testing.
7. There is little if any contamination of producing formations. Added to these qualities are the advantages in remote areas where hauling costs elevate the expense for water, mud, chemicals, and the like. Moreover, the climate has little effect on air-drilling costs. This is important in the Rockies where winter operations may raise drilling costs by 40%.

Field Cases

Following are specific case histories of air-drilling operations which are examples of the type savings made.

Big Flat, Utah . . . Air proved to be the most economical circulating fluid in a series of four wells drilled in the Big Flat area of Southeast Utah. At the discovery well in the field, 276.5 hours was lost in fighting lost circulation alone. The offset well which used air, reached the intermediate casing point in only 183.75 hours.

The rig was on day work on the second well, with the operator supplying bits and air service. After surface casing had been set at 665 ft., it took only 13 calendar days to drill 3,742 ft. of 12¼-in. hole. Three of the four wells drilled a comparable interval with 12¼-in. bits. Only 17

This article is a condensation of a paper titled, "Economics of Air Drilling in the Rocky Mountains," presented at API Division of Production's 1959 spring meeting of the Rocky Mountain District, Casper.

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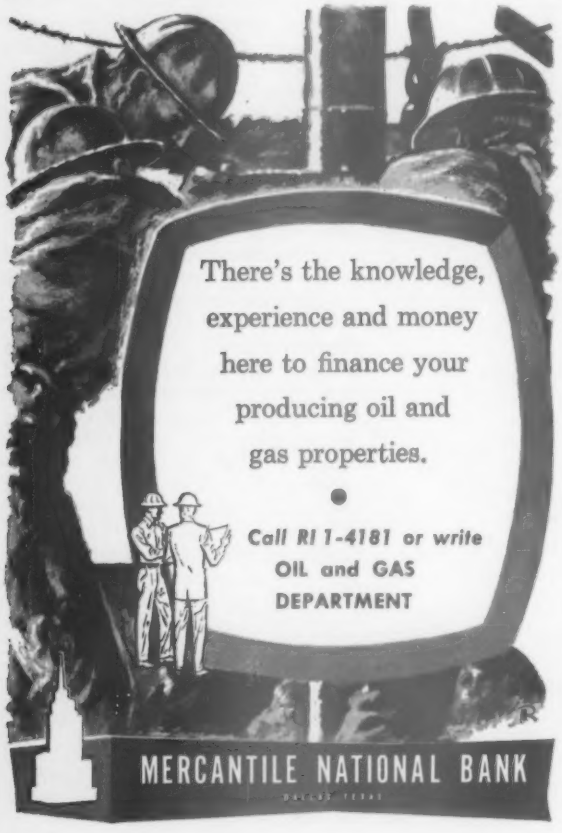
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bits were needed with air, whereas mud and aerated mud used 37 and 33 bits, respectively. Bit-cost savings alone in the air-drilled hole exceeded $5,000.

The average footage per rotating hour with air, exclusive of time spent circulating air to dry up the hole, was 22.5 ft. per hour. Aerated-mud penetration rate was only half as fast (11.98 ft. per hour). Penetration rate with mud averaged slightly better than 6.5 ft. per hour, or about one-third the speed of air.

With the 12¼-in. bits, an average footage per bit with mud was 107.6. Aerated mud improved this only to 114 ft. per bit. Footage per bit was about doubled with air (214.2 ft. per bit).

In the air-drilled hole water was successfully overcome with a combination of mist drilling and $132 worth of foaming agent.

On a comparable drilling-cost per foot basis, air drilling at $9.05 per foot was $4.80 per foot cheaper than aerated mud. In comparison with two mud-drilled wells, air drilling effected savings in excess of $6 and $10 per foot. Using the 3,700-ft. interval involved in the four-well comparison, footage savings add up to $22,000 and $37,000 over conventional drilling. The savings of air over aerated mud exceeded $18,000.

Aerated mud was selected by the operator to overcome the lost circulation expected and combated at the particular Big Flat location.

It is, of course, possible to convert from air drilling to aerated-mud drilling if necessary. The reverse, however, is not possible, because of the lower compressor requirements of aerated-mud drilling. The greater flexibility which commencement with straight air drilling provides should not be disregarded in air-cost estimation.

Raton basin . . . In Colorado's Raton basin air was used steadily for 4 months of drilling, with the well making an almost solid stream of water through the 7-in. flow line.

Air drilling was selected because a previous well in the area had severe lost circulation and water costs had been astounding. Air drilling reached the projected depth of 7,000 ft. in spite of the water volume encountered. Although the air service charges were approximately equal to the mud bill on the previous well, several months and 60 bits were saved.

A previous experience by another operator in the Raton basin of New Mexico showed some startling cost comparisons.[2] Drilling costs of five wells, prorated to 3,000 ft., show an average cost per foot for the air-drilled wells to be approximately $10. For the three conventionally drilled intervals of 3,000 ft., the footage costs are $38.66, $29.13, and $25.66.

Little Buck Creek . . . In the southeastern Powder River basin at Little Buck Creek this same article[2] discloses that, in a three-well comparison, air was highly successful. Two wells were drilled with air resulting in a total drilling cost of less than $10,000 for 8,139 ft. of 9-in. and 9⅞-in. hole. On a compared basis, mud drilling one well to 4,030 ft. cost the operator $8,433. Another mud-drilled well in the area cost almost $44,000 to reach a comparable depth.

Disturbed belt . . . In Montana's Disturbed Belt one article notes that ". . . penetration rates were higher, bit runs were longer, and straighter hole was drilled when using air as compared to mud."[3]

Compressor rental and all associated charges were $51,300 on the air-drilled well for approximately 10,050 ft. Mud costs of $12,200 boosted total fluid cost to $63,500.

Wells "A" and "B" with which the air-drilled hole was compared were conventionally drilled. Well "A," located 20 miles south of the air-drilled hole, cost $390,000 to drill and abandon at 9,392 ft. Mud cost was $28,000 or $35,000 less than fluid costs for the air-drilled hole. Whereas the cost per foot for drilling Well "A" was $41.52, the air-drilled hole cost $29.35 on a comparable basis.

Well "B," which cost the operator $550,000 when abandoned at a total depth of 12,920 ft., was located in the Disturbed Belt some 25 miles northwest of the air-drilled completion. Well "B," with an $18,000 mud bill, terminated with a cost per foot of $43.24.

The operator of the air-drilled well estimated $100,000 saved through the use of air.

Other examples . . . Time savings are important in the economics of drilling. In the shallow Bannatyne field of Montana, cable tools average 5.47 ft. per hour. Mud drilling increased penetration to between 8 and 10 ft. per hour. Air drilling averages 29 ft. per hour.

At Bar-X field straddling the Colorado-Utah line, one operator has drilled and completed six wells with air at a cost of $10.50 per foot. In the same field mud drilling and completions have averaged $18.50 per foot. On this basis three holes can be drilled in the field using air as the circulating medium for less than the price of two mud-drilled holes. By the use of air the final cost of a nonproducer has been reduced approximately $2 per foot.

Drilling Practice

A drilling practice which contributes greatly to cost savings with air is the standard use of hard-formation bits. In virtually all formations in the Rocky Mountain area, the hard-formation series bits have been most economical. Penetration rates are comparable with softer-formation bits. However, it is the extended bearing and tooth life which deserves credit for maintaining economies where water invasion must be controlled.

Formerly, upon hitting a water zone, a trip was made to check the bit and to see if cuttings were building up on the drill pipe.

Recent experience has shown that it is better to stay in the hole and either:

1. Drill ahead slowly and seal off the water zone with air and wet cuttings.
2. Switch to mist drilling by adding water to the air-input system.

Time is of the essence when combating water in a long shale section that might hydrate and heave under prolonged exposure to the air-water drilling fluid. The need to make two or three extra trips to change bits may mean the difference between completing the hole with air or mudding up.

The longer life of the hard-formation series bits counteracts the build-up of a column of fluid during a trip by keeping the bit on bottom longer, drilling and circulating. Frequent trips would require equally frequent unloading of a fluid column. The higher pressures needed and the increased uphole velocity of the fluid can be expected to have a detrimental effect on the hole walls.

Likely, some recent air-drilled holes would have had to be mudded up if tungsten carbide bits had not been in use. These same cases suggest that the higher cost of tungsten carbide bits is further offset by longer life in certain abrasive formations of the Rocky Mountain area.

Mist-drilling technique has been the thriftiest means of combating water invasion so that air may take the hole to projected depth. Water is by far the most inexpensive additive used to control fluid invasion into the bore hole. Water in the hole and the mist-drilling technique do not affect geologic evaluation. Tops can be determined as easily. Only the color changes, apparent in the dust of dry drilling, will not be evident.

Pressure requirements for mist drill-

ing are neither high nor unusual. Compared to a hydrostatic pressure of some 3,500 psi., with mud at 7,000 ft., mist drilling would exert only the circulating pressure of perhaps 250 psi. on the formations adjacent to the bit.

Small hole sizes preferred . . . From the point of view of horsepower requirements for adequate circulation, Rocky Mountain experience gives preference to the 7⅞-in. hole. Either 3½ or 4½-in. drill pipe can be used. In air, bearings and life of the 7⅞-in. bit compare favorably with the 9-in. size. Although it may exclude the possibility of running an intermediate string, the 7⅞-in. hole size appears best for maximum effectiveness in combating water entry.

How much air is needed? . . . Fig. 1 presents the compressor-unit requirements for various-sized holes. The depths which can be reached vary with hole conditions as indicated by the figure.

Air costs may be estimated by determining the number of units required. The number of units times 1.18 equals the daily volume of air in millions of cubic feet. Assuming dry conditions and an average penetration rate of 30 ft. per hour, it is possible to find the number of rotating hours to reach the depth desired. Converting the total rotating hours to days and multiplying by daily volume of air results in a rough estimate of total compressed-air requirements. And, since the cost of compressing air under standard conditions is between 21 and 26 cents per M.c.f., a crude idea of air cost to the selected depth can be obtained.

Natural gas has also been used when the location is near a field or pipeline. Pipeline gas varies in price, but a recent well on Colorado's western slope took pipeline gas at 18 cents per M.c.f. If the wildcat test had proved successful, the drilling gas was to have been repaid at 12 cents per M.c.f. The operator paid a hookup charge of $150, as well as labor, for laying and taking up the rented pipeline from the transmission line to the wellhead. In view of these costs, and considering the higher volumetric requirements for natural-gas drilling, it appears doubtful that natural gas was competitive with compressed-air costs.

Put air into contracts . . . Few Rocky Mountain drilling contractors have found it economical to invest in compressor equipment for air drilling. Air drilling has been done usually only where the operator specified it. In these cases the rigs have usually been on a day-work status.

Almost without exception wells are bid on a mud basis. Only on a few rare occasions have contractors attempted to fulfill their contracts by using air.

Opinion among contractors is that the chances taken with air drilling are too great for their profit margins. On several wells contractors have been penalized financially because of the swiftness of the operation. Even before moving costs had been recovered through day-work rates, the hole had reached contract depth and was released.

Both contractor and operator would benefit from a contract which included provisions for the use of air. Such a contract would automatically recognize the contractor's need for a fair profit and return on his investment in equipment. It would also recognize that the operator is entitled to the lowest possible drilling costs, consistent with safe, workmanlike operations.

One contract of this type used the footage price for mud drilling as a cost base. The agreement provided that any savings over this price through the use of air would be split between contractor and operator. Were air-drilling costs in excess of the base footage price, the difference would be paid by the operator.

Program thinking pays off . . . Some idea of the potential of air drilling exploratory programs may be gleaned from the experience of a major company operating in the Texas Panhandle. Natural gas was the target and air drilling was chosen as the best means of finding it. The first well was dry and abandoned. The second well was forced to convert to mud. At this point the drilling costs were in excess of two mud-drilled wells.

This was not a two-well exploratory program and several more tests were drilled before production was established and the proper air-drilling technique for the area decided upon. At last count, air had been used to drill 241 wells ranging in depth from 2,100 to 2,700 ft. One bit per well is the average from under surface to total depth. Average rotating time is less than 29 hours per hole.

There are several areas in the Rockies, now undergoing exploration and exploitation, which would be suited to air programing. In the Green River basin, for instance, a major company planning an extensive exploratory program has commenced its second air drilled well. The first was air-drilled with no spectacular results, not a few headaches, and an over-all cost equaling conventional drilling.

The repeated use of air reflects a strong belief that air can be made to work once the techniques for the area are established. Once this has been done it is essentially a certainty that exploratory drilling costs will be lowered.

There has been a lack of "program thinking" with air for developmental drilling in the Rockies. On a 10-well series more time could be economically spent in air drilling the first two wells to obtain maximum savings on subsequent drilling and completion practices and techniques.

Logs can lie . . . Two Big Horn basin field wells completed earlier this year suggest that logs may be misleading. The first well was air drilled to projected depth. There were flows of 35 bbl. per hour in each of two zones. After completion, an offset well was spudded.

Records from surrounding wells indicated that these two zones would be water-bearing in the second well also. Yet the careful preparations to squeeze the zones proved unnecessary. Air drilling penetrated these horizons to find a "weeping" rather than a flowing water condition. What happened to the water? How valid are the records on which we base our assumptions of formation content and character? Is a permeability barrier present? De we have clues to possible production from these zones elsewhere on the structure? The answers to these questions may be of real significance to the operator.

Air drilling has supplied important subsurface information, contrary to expectations, elsewhere in the Rockies. In northwestern Colorado an air-drilled hole reached projected depth with absolutely no indication at any time of oil, natural gas, or water. Prior to abandonment the well bore was filled with fluid and logged. By the usual interpretive techniques, several water-bearing zones were obvious on the log.

Another exploratory air-drilled hole in Wyoming, similarly void of all fluids, was also filled with water for logging purposes. Apparent hydrocarbon kicks were visible on the log. It was only with difficulty that the operator's representative was dissuaded from running a drill-stem test.

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Here are the results of a study made on

Economics of cathodic protection

BY N. K. SENATOROFF
Supervisor of Technical Services,
Pacific Lighting Gas Supply Co.

This author declares...

"Expenditures for a carefully conceived plan of corrosion protection, though small, are to my mind the most realistic and necessary investment in construction of a gas pipeline."

IN STUDYING available means for corrosion protection of large-diameter pipelines, the designing engineer is confronted with the task of selecting the most economical method from the several practiced in related industry. He can select the use of mechanical type of protection in the form of outside wrapper or of laminated coating. Or he can apply electrochemical currents—cathodic protection.

In the final analysis and in most cases, the economic factors will dominate the design engineer's decision. Unfortunately, of the many economic factors involved, too often only the first cost is considered.

In comparing the economics of protective measures, the design engineer, however, must evaluate other factors—such important variables as types of coating materials, coating thicknesses, wrappers, geographical locations of the pipeline, season during which construction is performed, type of construction (bell-hole or over-the-ditch), service-life expectancy of the project, and maintenance costs.

The possibility of cathodic protection for corrosion mitigation on a poorly coated high-pressure natural-gas transmission line had been studied by our company as far back as the summer of 1941. A gas-driven generator had been installed to protect a section of 26-in. o.d. pipeline, which in approximately 10 years of service, had been developing increasingly difficult leakage problems.

"Drainage" currents as high as 90 amp. per generator were sufficient to arrest only those corrosive effects of the soil which would have continued had the pipelines remained undrained. The leakage frequency had not declined perceptibly on the "protected" 4-mile section of the line.

An installation of another generator of the same type and capacity 2 years later had not helped the leakage record. A year later we decided to recondition and recoat this section of the line with "good" coating. Further study was planned as to the effectiveness of cathodic protection when used in conjunction with a good coating.

The technical and economic advantages derived from the coating used in conjunction with cathodic protection are stated in the table at right.

In recent years corrosion-preventive practices have swung toward the use of combinations of coating and cathodic protection rather than coating or cathodic protection. There are advocates of poor coating with extensive reinforcement by cathodic protection and there are those who favor the use of the best available coating with the minimum of cathodic protection.

The different views require careful economic analysis before a final decision is made. Without it, or as a result of casual interpretation of its conclusion, large sums of money may be wasted.

Economics of Cathodic Protection

In July of 1958 Pacific Lighting Gas Supply Co. had completed construction of the 34-in. o.d. Grade X-52 transmission line between Taft, in Kern County, and Newhall, Calif.

The economic study of the two alternative corrosion-protection systems at the outset substantiated our engineering recommendations. This was to use good coating over the entire line, not to include provision for corrosion allowance in the form of an extra wall thickness, to install contact points (electrical test points) at the time of line construction, to design cathodic-protection stations, and to apply cathodic protection at as early a date as possible.

Preliminary cost estimates of the proposed protective system were made as follows:

The question of spot coating the line where needed versus coating the line for an entire length was resolved on the basis of the questionable reliability of soil-survey data and value for this project.

Today's dry "noncorrosive" sections of land have been crisscrossed with irrigation ditches, which constantly are being flooded and enriched with mineral fertilizers. Soil corrosivity indexes or pH values before and after conversion bear little resemblance to one another. In certain areas soils become veritable mires of dynamic corrosivity for the inadequately coated pipelines even with adequate provision for cathodic protection.

Cost of Coatings

Total installed cost of the coating (including labor and overhead, and strongly reinforced coating for canal crossings with added cost of enamel 2/32-in. maximum thickness and bonded asbestos wrapper) came to $6,971.38 per mile or $568,725 for the 81.58 miles of the entire line.

The costs even of an expensive coating vary, but variation in cost of one material of a laminated type of coating does not necessarily affect the over-all cost as much as the price of the single material.

The total cost of asphalt-derivative coating installed under identical specifications and of supposedly identical dielectric qualities would be $498,666 or $6,112.60 per mile, versus $568,725 or $6,971.38 per mile for the coal-tar coating.

Expensive Coating vs. Less Expensive

Most of the major transmission

CATHODIC PROTECTION—COST AND OPERATING DATA

	Unit No.	Current amp.	Miles protected	Pipe (in.)	Investment	Annual maintenance
Before reconditioning ..	85-1	90	4.4	26	$5,984.48	$370.78
After reconditioning	85-1	25	8.5	26	$5,984.48	$370.78

lines of the three Pacific Lighting Corp. subsidiaries are coated with coal-tar derivative enamels. From past experience it was reasonably safe to assign a useful life for such a coating of 30 years.

The quoted price for asphalt-derivative enamel was $50 per ton or 33% cheaper. Money was available at 6.5%. Because of uncertainty of useful service of asphalt-derivative enamel beyond 20 years of assumed life, the following further cost studies were made on both materials.

Capitalized Costs Methods

Whenever there is a choice of different materials in the design of a project, one must compare the costs of the alternatives in order to arrive at the most economical selection of materials. The use of the capitalized cost method is based on the assumption that the most economical coating material is the one which has the lowest capitalized cost over the life expectancy of the pipeline.

The concept of capitalized cost embodies the first cost plus the present value of an infinite number of renewals. It is the cost on a perpetual basis.

The application of this concept can be illustrated by a simple example.

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PIPE LINE SURVEYS

Consider coal-tar coating applied and including overhead costs of $6,971.38 per mile. Assume that money is available at 6.5%. The capitalized cost of this type of coating is equal to:

$$\$6{,}971.38 \times \frac{(1+i)^m}{(1+i)^{m-1}}$$

$$= \$6{,}971.38 \times 1.181 = \$8{,}183.20$$

In this fractional factor exponent, m = life of the coating reasonably estimated at 30 years.

Let us suppose an asphalt coating identically applied and priced at $6,112.60 per mile. Other types being equal, except that its life would be assumed to be only 20 years, the capitalized cost of this type of coating would be equal to:

$$\$6{,}112.60 \times \frac{(1+i)^m}{(1+i)^{m-1}}$$

$$= \$6{,}112.60 \times 1.401 = \$8{,}557.64$$

In the final analysis the cheaper asphalt-derivative enamel is more expensive than the initially high-priced coal-tar derivative enamel.

The capitalized cost method is very useful in providing other pertinent answers.

Suppose one is interested in knowing the added cost he can economically justify for the coating which lasts 30 years as compared to the price of $50 per ton for an asphalt derivative which is guaranteed to last only 20 years. The solution is straightforward:

$$\$6{,}112.60 \times \frac{(1+i)^{20}}{(1+i)^{20-1}}$$

$$= \$X \times \frac{(1+i)^{30}}{(1+i)^{30-1}}$$

$$\$6{,}112.60 \times 1.401 = \$X \times 1.181$$

$$\$X = \frac{\$6{,}112.60 \times 1.401}{1.181} = \$7{,}245.55$$

Thus, any cost of applied coating less than $7,245.55 per mile would be economically profitable. The $6,971.38 cost of the applied coal tar obviously falls well within this range.

Stating it another way, the "expensive" coal-tar derivative enamel coating would have to last approximately 27 years versus 20 years of less-expensive asphalt-derivative enamel coating in order to justify its extra cost. The 34-in. valley line in question was designed on the basis of long-term contracts with producers and high pipeline pressures.

Wall Thickness vs. Cathodic Protection

The materials list, specifications, tonnage, and delivered costs of extra wall thickness vs. cathodic protection are given in the table below.

By eliminating 0.125-in. average pipe-wall corrosion allowance, the resulting saving in tonnage of pipe, as a direct factor, amounted to approximately 25.5% of the 36,618.07 total tonnage or 9,352 tons. At a delivered

Wall (in.)	Total footage	Inches o.d.	Weight (lb. per ft.)	Tons	Delivered cost
0.600	1,225	34	214.03	131.09	$44,866
0.566	52,445	34	202.11	5,299.83	1,389,852
0.500	205,899	34	178.89	18,416.64	3,993,128
0.416	171,175	34	149.21	12,770.51	2,889,447
0.480*	430,744			36,618.07	$8,317,293

*Average.

$8,317,293/36,618.07 tons = $227.14 per ton, an average delivered price for pipe.

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WRITE FOR CATALOG S-1

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Completely self-contained gas or air-powered instrument driving and timing unit for long, trouble-free operation in remote locations. The GASCLOK delivers more than 20 times the torque of conventional spring-wound mechanisms. Continuous timing accuracy is unaffected by a ± 20% variation in supply pressure.

Inherently explosion proof and self-starting, the GASCLOK is ideal as original or replacement equipment for strip chart and conventional circular chart instruments. The timing mechanism is internally sealed to prevent corrosion, and all power unit parts exposed to gas are aluminum or stainless steel. Large area internal ports prevent clogging. Normal air or gas consumption 5 cfh . . . operating pressure 5 psi . . . rotation 2 rpm.

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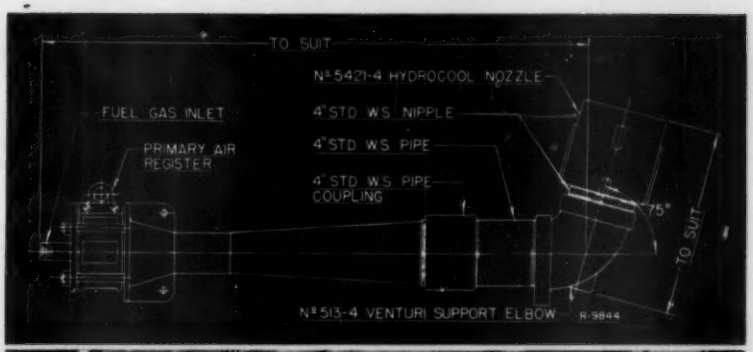

Firing Hydrogen

IN A CENTER WALL UP-DRAFT FURNACE

The HYDROCOOL Burner-Nozzle was developed and is manufactured solely by National Airoil Burner Company. It provides safe operation with Hydrogen or Hydrogen rich gas fuels in any type of petroleum or chemical furnace. It will also efficiently burn any other gas, such as natural or by-product types.

As compared with the conventional natural or refinery gas burner nozzle, the HYDROCOOL will produce a short, hot, stable flame with a high turn-down ratio, and with extremely low excess air at the nozzle.

HYDROCOOL Burner-Nozzles have been in continuous large scale commercial use in oil refineries throughout the United States, Europe and the Near East.

HYDROCOOL Nozzles have frequently been used as replacements for our Airocool Nozzles, as well as other makes of nozzles where the previously high density gas has been replaced by Hydrogen.

Write us for further information — and please use your Business Letterhead.

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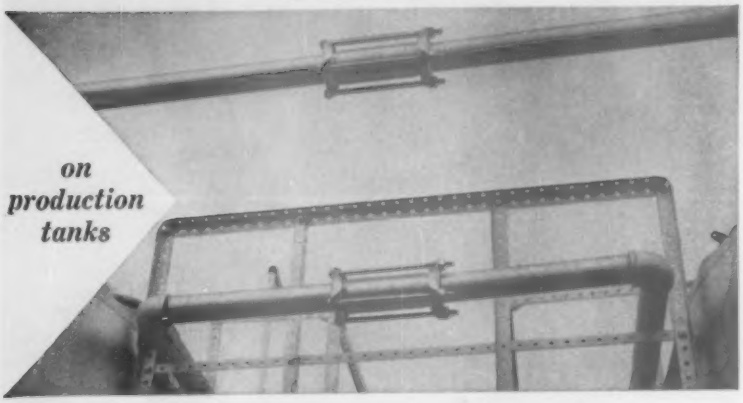
Dresser® Couplings—



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Dresser Couplings make safe, permanent joints with only a simple hand wrench in two man-minutes per bolt. This is a *part* of their economy . . . no specialized tools or labor. You save even more because the Dresser Coupling is used with plain end pipe. The specially compounded Dresser Gaskets allow up to 4° pipe deflection at every joint, saving delays caused by misaligned pipe. Take-down ease and re-usability are tremendous assets in moving pipe, and in adding new pumps, valves, or branch and connecting lines. Send for Dresser Catalog No. 531 . . . information and specifications on *all* Dresser Couplings, Fittings, and Pipe Repair Products.

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cost of $227.14 per ton, the saving amounted to $2,124,213, creditable at least in part to cathodic-protection account. To this saving of course would have been added other factors such as higher freight charges for larger tonnage, extras for loading and unloading, for stock piling and others.

Cathodic-Protection Costs

The total cost of instrumentation, materials, and labor for the installation of two cathodic-protection rectifier-type stations was $46,780. The cost includes the 11 major full-line-size insulating flanges, the 216 contact points (electrical test points), and the two 10-amp.-capacity rectifiers plus management's overhead.

Thus, the supplementary corrosion mitigation was added to the coating protective value, to make the pipeline immune to corrosion damage. The added capital investment for cathodic protection was included in the $14,124,834 over-all cost of the pipeline and amounted to only 0.33%. Looking at it another way, the investment for cathodic protection amounted to only 2.20% of the investment which would have been necessary for the extra wall thickness.

The details of investment and operating costs for cathodic protection are given in the following tables:

INVESTMENT FOR CATHODIC PROTECTION—PROJECT LINE

Total miles of 34-in. o.d. pipeline protected	81.58
Installed cost of two cathodic-protection stations	$6,400
Installed cost of insulating flanges	29,100
Installed cost of contact points (electrical test points)	11,280
Total investment	$46,780
Average investment per mile	$573.43

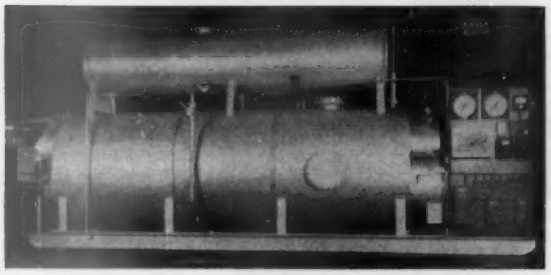
AVERAGE COST OF APPLIED CATHODIC PROTECTION—PROJECT LINE

Total amperage required for the line	12.3
Average amperage required per mile	0.151
Average annual operating costs	$1,322
Average annual fixed charges	4,688
Average annual total costs	$6,010
Average annual cost per mile	$73.67
Average annual cost per ampere	$489.00

It cannot be expected that the cost-study methods presented here will receive unanimous acceptance. Nevertheless, and regardless of the methods chosen, one cannot escape the conclusion that the installation and operating costs of cathodic protection in combination with good coating are small. Their costs may be compared to insurance and taxes.

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



Atmospheric-pressure liquid heater

. . . now in production is a tank-like oil or gas-fired furnace in which commercially available oil can be heated at atmospheric pressure to temperatures ranging from 350° to 650° F. The hot oil can then be circulated by a low-pressure pumping system to processing equipment.

Initial cost of the heater is said to be less than that of high-pressure heating systems and complicated auxiliary equipment is eliminated. Flash tanks, condensate-return systems, and air ejectors are not needed. Eight sizes of the heat generator are available with net continuous output ratings ranging from 500,000 to 10,000,000 B.t.u. an hour. **Contact Manufacturer: Allis Chalmers Mfg. Co., 1135 South Seventieth Street, Milwaukee 1, Wis., for details on liquid heater.**

The heater is completely submerged in the water section of the tank and operates with its fire chamber completely isolated from the atmosphere. Two intake pipes enter the burner housing for combustion-air introduction.

Safety valves and a thermocouple-actuated system eliminate the need for an electrical supply. Thus the unit can be installed in remote areas where electrical power is not available. **Contact Manufacturer: Space Corp., Box 636, Garland, Tex., for details on improved gun-barrel heater.**

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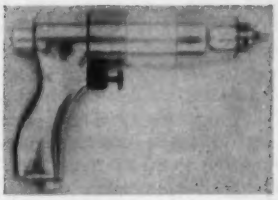
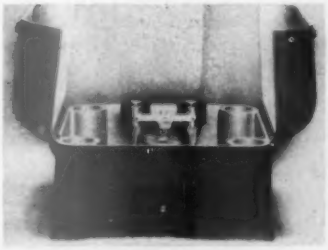


Governor controls pneumatic drill

. . . now on the market. Governor setting for the ¼-in. drill is readily adjusted from outside the tool. Speed can be set from 750 to 3,500 r.p.m. One drill can handle stainless steel or aluminum.

Air consumption is proportional to load. Full torque is available at any set speed. Full air volume is used only when load is applied. Over-all length is 6 in. Weight is 2¼ lb. **Contact Manufacturer: D-K Products, Inc., 1056 South Gerhart, Los Angeles, for details on pneumatic drill.**



Heated centrifuge with square shape

. . . recently made available has four preheater pockets instead of two as on former models. The 100-ml. Mark II centrifuge has the top divided into two lids, making it easier to work in and keep clean.

Since the machine permits preheating samples and keeping them hot during the spinning period, it promises more consistent testing conditions, regardless of the weather, and assures a higher degree of consistency and accuracy in b.s. and w. measurement.

The machine is made of aluminum and circulates hot water from the gager's vehicle motor into a large water reservoir in the bottom of the centrifuge. A rheostat control helps the operator start the unit gently and advance to the desired centrifuging speed. **Contact Manufacturer: W. L. Walker Co., 1009 South Main, Tulsa, for details on Mark II centrifuge.**

●

Gas-fired heater for gun barrel

. . . and heater-treater applications is now available in an improved version. A special steel used for the basic fabrication will increase the unit's corrosion resistance more than six times that of normal boiler-plate steel.

Send this Showcase Coupon

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

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Described in OIL AND GAS JOURNAL - Issue of July 20, 1959

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CITY.....STATE.....

Draw works for 24,000-ft. depths

. . . and rated at 2,000 hp. is now obtainable to handle today's demands for deep-drilling equipment both on land and offshore. The N-20 has a square-pod compound. Engines mount on each side of the compound. This cuts the over-all length to half that of older types.

Engines may be compounded in eight ways to meet the needs of different tasks for speed and power. Controls are grouped on the control panel to reduce driller fatigue and prevent error. For added safety, control handles are distinctively shaped for key operations. This permits the driller to select desired control by feeling the shape of the handle while keeping his eyes on the drilling floor.

The draw works can be moved overland in three loads. An optional remote-power arrangement is available for barge or offshore-platform work. **Contact Manufacturer: Brewster Co., Inc., P. O. Drawer 1095, Shreveport, La., for details on N-20 draw works.**

•

Bigger plastic flow tube

. . . is now being produced. The Dall flow tube for primary flow metering now comes in sizes from 4 to 48 in. Easy to install between pipe flanges, the flow tube is said to be specially suited to process use where acids, alkalies, slurries, and gases require accurate metering.

The Model DFT-PI plastic insert flow tube is made of glass fiber-reinforced epoxy or polyester resins with a metallic throat lining. It comes in a variety of sizes and flange and throat materials. Accuracy is within 1% of actual flow rate. **Contact Manufacturer: B-I-F Industries, Inc., 345 Harris Avenue, Providence 1, R. I., for details on Dall flow tube.**

•

Indicator on high-pressure filter

. . . now being produced shows differential pressure. Optional for the Series 2900 filter is a low-temperature lockout. The filter assembly includes the pressure differential indicator in the bottom of the filter bowl. As the filter element collects contaminant and the differential pressure rises across the element to 80 psi., ±10 psi., a red-tipped pin extends from the filter bowl, indicating the element needs cleaning.

The optional temperature lockout device prevents the differential indicator from functioning at temperatures below the range of 20° to 35° F. The filter element is a pleated metallic type designed to withstand a differential pressure of 3,500 psi. without collapse over a range of ± 350° F. Elements come in ratings from 2 to 40 μ. The aluminum housing handles operating pressures up to 5,000 psi. **Contact Manufacturer: Bendix Filter Div., 434 West Twelve-Mile Road, Madison Heights, Mich., for details on Series 2900 filters.**

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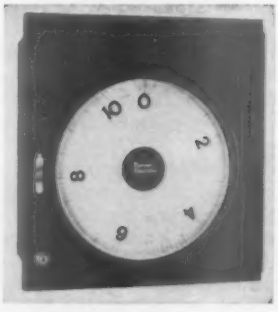

Electronic indicator, controller

. . . just developed lets you quickly and accurately obtain indication or indication and control of any variable that can be converted into an electri-

CM1

TRADE MARK TIME TESTED MACCO GAS LIFT REG. U.S. PAT. OFF.

MACCO DUAL COMPLETION EQUIPMENT
"Capsule" Mandrel and CM1 (1" O.D.)
Gas Lift Valve

The "capsule" type mandrel is available from stock for all standard dual, macaroni, and slim-hole lift. Special sizes are manufactured upon request. With the valve and check valve mounted inside, this type of mandrel provides extra large flow areas for the well fluids. The producing zones of parallel or concentric dual completions may be simultaneously lifted by either a "common" or "separate" gas supply. Macaroni tubing lowered inside of the regular tubing has proved a highly successful means of lifting wells where it is objectionable to pull the regular tubing. Efficient lift inside of small liners is also made possible.

The Macco fluid operated valve is particularly suited for dual completion lifting. A typical installation consists of separate, parallel strings of tubing, each equipped with Macco fluid operated valves mounted in capsule mandrels. The fluid of each zone controls the opening and closing of its valves. The casing annulus serves as the gas supply for each string of valves. Valve interference is eliminated and each zone is lifted independently of the other. No surface equipment other than a choke in the gas input line is needed.

Macco manufactures many different types of dual completion equipment to fit any well requirement. For further information, write for Brochures No. 3-12, 3-21, and 3-31.

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In this latest development we reaffirm our pledge to make a better gauge ever better. Only in the Marsh Christmas Tree Gauge you have:

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—**A better movement**—all but frictionless as a result of the self-lubricating effect of unlike metals. Coined sector gear gives greater strength where greater strength is needed; also smoother operation.

—**A better case**—a copper-clad wrought steel case of boiler plate thickness, produced by the "Marsh-alloy" process. It has the strength of steel, the corrosion resistance of copper, and is one-third lighter than conventional cast-iron cases. The case is finished in corrosion-resistant satin black enamel.

—**the Marsh "Recalibrator"**—not only the handiest way to keep a gauge accurate; also the *best* way.

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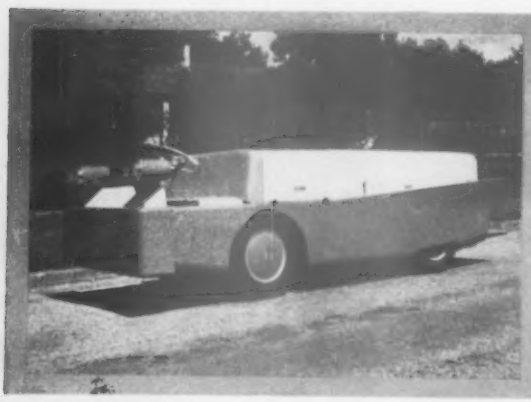

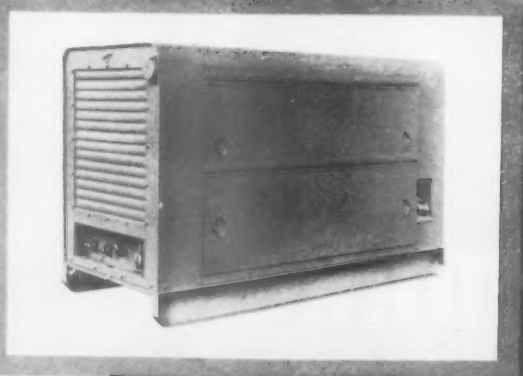

New Equipment

cal quantity, such as d.c. potential, current, or resistance. The self-balancing and bridge type of instruments are suitable for a number of processes.

Both units will check any of several hundred sensing elements which may be connected through switches or connector panels. Measured variables can be observed or controlled rapidly. The 34-in. scale dial gives you easy-to-see and accurate readings. Control contacts are adjustable to 100% of scale range. Up to six alarm contacts can be provided to which external lights or audible alarms may be connected. **Contact Manufacturer: Thermo Electric Co., Inc., Saddle Brook, N. J., for details on electronic controllers.**

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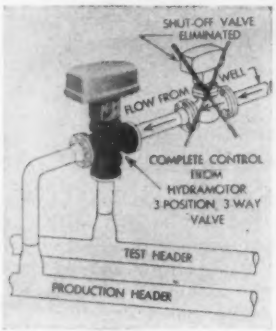

Three-position, three-way valve

. . . is now being produced that offers a means of simplifying automatic well tests. The valve can be used to control oil flow from a well to test tank or production headers. It performs these functions within a single valve unit, eliminating the need for a shut-off valve.

The Hydramotor valve will completely shut off flow from a well or establish flow into either of two lines. It is suitable for automatic tank-switching operations from a remote control panel while reducing the number of valves, fittings, and space for a given tank-switching control setup.

The valve is an electrohydraulic type and self-contained in an explosionproof and weatherproof housing hermetically sealed in oil against the elements.

The valve comes in sizes up to 4 in. IPS, with optional soft seats. Cast-iron bodies handle pressures up to 400 psi. Cast-steel bodies handle pressures to 1,500 psi. **Contact Manufacturer: General Controls, Inc., 801 Allen, Glendale, Calif., for details on three-way valve.**

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"BABY-SITTER"
with finest references!

Penn Safety Controls will "baby-sit" your costly engines 24 hours a day with complete safety! Even in the best of engines overheated cooling water or oil pressure failure can develop. When it does, Penn Controls automatically warn you of the trouble or stop the engine, whichever you prefer. Learn more about this low-cost protection for new or old engines. Write for full information.

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AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

Bulk storage plant for gasoline

. . . and oils now being produced can be set up or torn down in about 2 hours. It is suited, according to the maker, for use under any job situation, any terrain, and in storage capacities ranging from 5,000 gal. up.

One significant feature is that conventional steel tanks can be used. Or the recently developed collapsible-fabric tanks that roll up for transporting can be used. A 30,000-gal. pilot model of a bulk-storage plant that can be erected in 2 hours has been field-tested for 24 months. The maker reports no "bugs" or abnormal mechanical problems have developed. **Contact Manufacturer: Petroleum Systems, Inc., 2914 Grand Boulevard, Detroit 2, for details on Migrant storage plant.**

Transistorized analog computer

. . . which can now be obtained is capable of performing up to 95% of the routine mathematical operations encountered by an engineer in normal design calculations. The TR-10 computer is 15 in. wide, 17 in. deep, and 24 in. high. It weighs only 80 lb., without accessories. It occupies little more desk-top area than a conventional electric typewriter. Two of the amplifiers, packaged as a single shielded unit, occupy a space measuring only 1½ by 5 by 6½ in.

The computer offers a way to apply analog computation to the solution of every-day engineering problems. It provides a solution of certain problems in a fraction of the normal time required. Price of the new computer starts from under $4,000. Readout equipment, such as plotters and recorders, range in price from $1,350 to $1,900. Accessories needed depend upon whether the user wants his problem solution presented numerically or in graphic form. **Contact Manufacturer: Electronic Associates, Inc., Long Branch, N. J., for details on TR-10 computer.**

●

Lightweight pan and tilt table

. . . for industrial television cameras is now being made available in both automatic and manual models. The camera mount is light enough to be used on conventional camera tripods. The basic pan-tilt head consists of two fractional horsepower motors with drive system encased in an aluminum housing. The tilt table is driven by one motor and allows the operator to aim the camera 45° above and below horizontal. The other controls panning.

Available as Models ARC-12A or B, the pan-tilt unit is equipped with dynamic braking for panning and tilting. This enables the operator to stop the camera without jerking or overshoot. **Contact Manufacturer: Kin Tel Div., Cohu Electronics, Inc., Box 623, San Diego 12, Calif., for details on ARC-12 pan-tilt units.**

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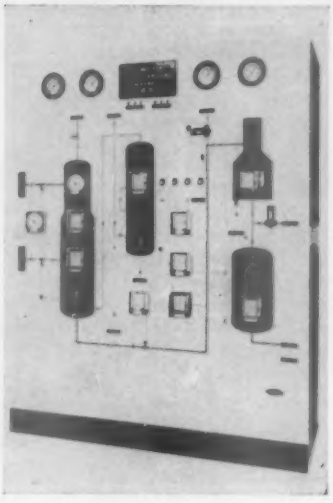


Magnesium control-panel boards

. . . now being produced are lightweight and easy to alter in the field. They hold promise of substantial savings in time, effort, and cost when installing additional instruments or making other panel alterations in the field.

The need for blow-torch cutting or welding during alterations is completely eliminated, providing added safety for hazardous atmospheres. The panels can be faced on one or both sides with 1/16 in. sheet Formica or Mylar as required. **Contact Manufacturer: Panellit, Inc., 7401 North Hamlin Avenue, Skokie, Ill., for details on magnesium control panel boards.**

●

Three-cone integral jet bit

. . . now placed in production has the jet nozzle housing as a part of the forging. The jet nozzle inserts are of tungsten carbide and are removable to allow selection of sizes to suit the drilling requirements.

The bits for either air or fluid use can be obtained in sizes of 6¾, 7⅞, 8¾, and 9 in. The jet nozzle is positioned so drilling fluid strikes the bottom of the hole with enough force to develop a cutting action of its own. This action cleans the cuttings off the bottom where they will not be recut by the teeth of the bit. **Contact Manufacturer: Varel Mfg. Co., 9230 Denton Drive, Dallas 20, for details on three-cone jet bits.**

SHOWCASE . . .

New Literature

Attapulgus clay and activated bauxite

. . . products specially adapted for the petroleum industry are described in new Technical Bulletin 402. The four-page literature discusses grades of attapulgus-clay products, such as percolation and contact grades; special grades for catalyst-poison removal, and for saltwater drilling mud.

It details activated bauxite products, which include Porocel, Driocel, and Dyclocel. Each product is described and typical petroleum applications are discussed. **Contact Manufacturer: Minerals & Chemicals Corp. of America, Menlo Park, N. J., for Technical Bulletin 402.**

Oil-well pumping controller

. . . designed for outdoor operation in oil-field applications for full-voltage starting of polyphase motors up to 100 hp., 440 volts, is outlined in a new four-page publication. Bulletin GEA-6963 discusses the controller's features and benefits and contains a technical description including identification of all component parts. **Contact Manufacturer: General Electric Co., Schenectady 5, N. Y., for Bulletin GEA-6963.**

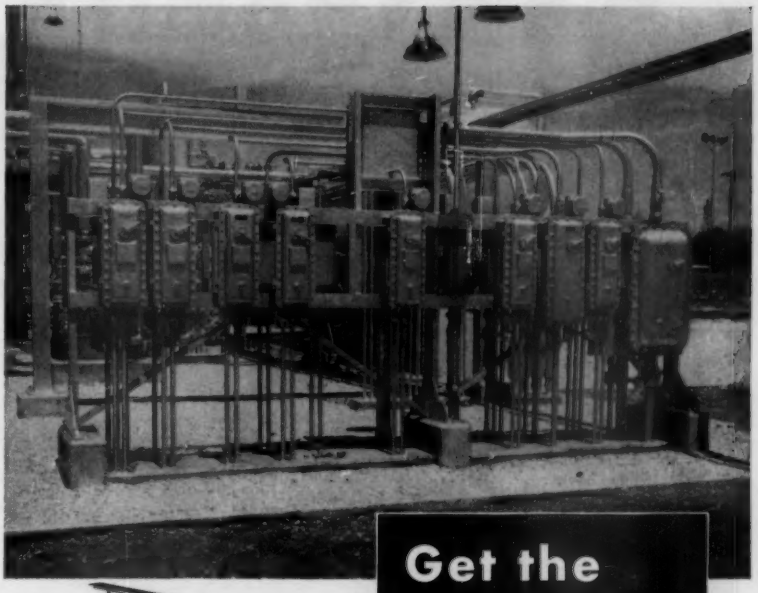
Double-barrel insert-rod pump

. . . designed so that it can be removed on the rods for servicing, yet produce at high capacities, is described in new Bulletin 204. A cutaway drawing and a specifications chart are included, along with charts which compare the pump with others of the same size. **Contact Manufacturer: Pacific Pumps, Inc., 5715 Bickett Street, Huntington Park, Calif., for Bulletin 204.**

Packaged field compressors

. . . are outlined in a new 28-page bulletin which presents advanced design and operating features. The literature describes and illustrates: balanced/opposed compressor for vibrationless performance; new positive direct drive that eliminates belts and gear-type transmissions; unitized, vertical air-flow radiator; oil-field engines driving the compressor at 1,000 r.p.m. speeds; conservative piston speeds—833 ft. per minute; rigid, I-beam skid; and factory packaged assembly.

Bulletin 158 contains specifications for two and four compressor-cylinder models built in 15 sizes from 100 to



Get the economies of factory assembly

. . . plus satisfaction of field personnel by using Nelson Switchracks

Centralized motor control is the modern trend. In the above photo you see a Nelson switchrack with various components including control switches to motors driving the processing pumps in a fractionating plant of Warren Petroleum Corporation.

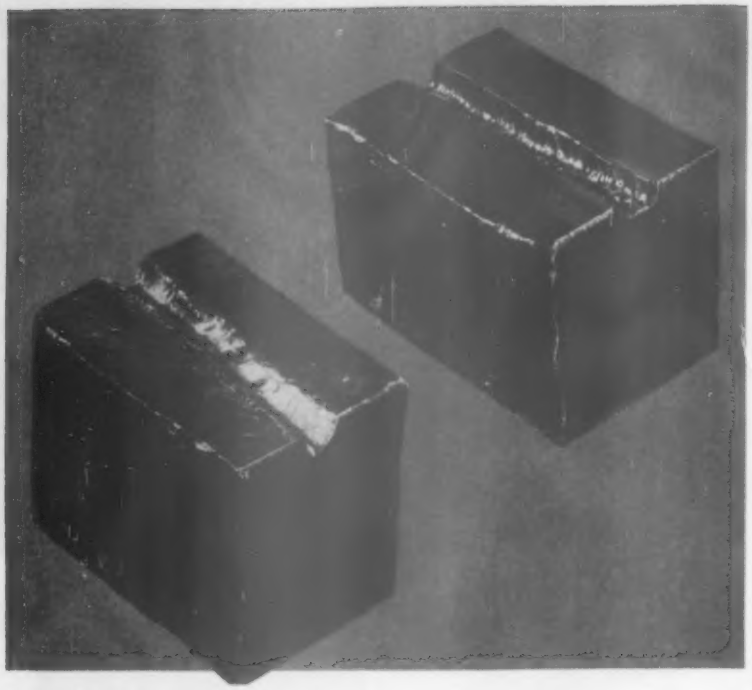
For outdoor installations Nelson switchracks provide ease of installation and all the advantages of factory assembly and wiring. One purchase order, one receiving report, yet you receive a complete unit. At Nelson each switchrack is specially designed to give the customer the ultimate in performance.

Nelson switchracks are available in either single front or double front, and with or without canopies for weather protection. Components can either be explosion-proof (NEMA 7), watertight and dust-tight (NEMA 4 & 5) or oil immersed (NEMA 8). If you have no preference for arrangement Nelson engineers will design to give you maximum utility in minimum space.

For more complete information write for Bulletin 497

At Nelson . . . *quality* comes first!

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA



Which stainless steel block was grooved in just 12 seconds?

It took 10 minutes to chip a ¼" deep, ⅜" wide groove in this 3¼" long stainless steel block on the left. Arcair did a better job in just 12 seconds . . . or 1/50th of the time. (See block at right.) Groove is 5/16" deep; 7/16" wide. Both blocks were cut from the same stainless steel bar.

You can groove, cut, gouge or bevel *any* metal faster with Arcair . . get significant cost savings. Yet, the Arcair process costs less than $100.

HOW DOES ARCAIR WORK? The torch uses 80 p.s.i. air, welding machine current and special electrodes to melt and instantly blow away metal. There's no oxidation. New operators learn everything in 15 minutes.

WHAT'S YOUR PROBLEM? Write us. Without obligation, we will recommend correct torch and method to help you cut costs. (Or, call your Arcair welding supply distributor.)

Arcair

THE ARCAIR CO.,
479 S. Mt. Pleasant St., Lancaster, Ohio
Send me more information on Arcair Torches and special electrodes.

(NAME) (TITLE)

(COMPANY)

(ADDRESS) (CITY) (STATE)

MY PROBLEM

350 b.hp. **Contact Manufacturer: Clark Bros. Co., Lincoln Avenue and Fifth Street, Olean, N. Y., for Bulletin 158.**

Phonograph record of fine German music

. . . now is being offered free upon request by a West German manufacturer of mud additives and other chemicals for the oil industry. On the flip side of the record is a courteous, friendly salute to the American oil industry on its 100th anniversary. **Contact Manufacturer: Kalle & Co., Aktiengesellschaft, Wiesbaden-Biebrich, Western Germany.**

Industrial-gases catalog

. . . offers a comprehensive survey of how gases are made, delivered, and used. Gases discussed are oxygen, nitrogen, argon, helium, acetylene, hydrogen, carbon dioxide, and the rare gases—neon, xenon, krypton, atmospheric helium, and specially purified argon.

Thirty-two page Catalog ADC 892 also contains a conversion data table and a table on the physical properties of the gases. **Contact Manufacturer: Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 150 East Forty-second Street, New York City 17, for Catalog ADC 892.**

The Plant You Want to Build

. . . is the title of new obtainable Brochure 0-59-1, which details the character and world-wide range of process-engineering services offered by a major firm.

The 24-page publication describes how the company has integrated facilities of its domestic and foreign subsidiaries to provide optimum organization to design, engineer, and erect whatever plant is desired. **Contact Manufacturer: Foster Wheeler Corp., 666 Fifth Avenue, New York City 19, for Bulletin 0-59-1.**

Two new process pumps

. . . called Fig. 3675 and Fig. 3775, designed for petroleum processing, are described in new Bulletin 724-1, free for the asking. The Fig. 3775 frame-mounted centrifugal pump is available in 11 sizes with capacities up to 850 g.p.m., heads up to 350 ft., and a maximum operating temperature of 600° F.

Fig. 3675 is a close-coupled version of the other model with the pump end bolted directly to a flange-faced motor and the rotating pump parts assembled on the motor shaft extension. It's also available in 11 sizes with capacities up to 850 g.p.m., heads to

350 ft., and a maximum operating temperature of 275° F.

The eight-page bulletin gives specifications, photographs, dimensional drawings, and construction data. **Contact Manufacturer: Goulds Pumps, Inc., 59 Black Brook Road, Seneca Falls, N. Y., for Bulletin 724-1.**

Electronic-computer system

. . . solves scientific problems, as described in a new 16-page bulletin now available. The literature outlines speeds, capacities, and over-all performance qualifications of the Honeywell 800 system.

It gives specific examples of how its design logic and other features contribute to its use and economy in scientific computation. **Contact Manufacturer: Datamatic Div., Minneapolis-Honeywell Regulator Co., 151 Needham Street, Newton Highlands, Mass., for Honeywell 800-A Superior Scientific Computer.**

Equipment and technical-services

. . . guide lists hundreds of products and services of 13 operating companies of Dresser Industries, Inc. The colorful, 68-page book offers information in 77 categories, ranging from amplifiers to well completions. It includes lists of company representatives and their addresses throughout several countries.

A pictorial section at the back of the guide gives a display of Dresser equipment on the job throughout the world. **Contact Manufacturer: Dresser Industries, Inc., Republic National Bank Building, P. O. Box 718, Dallas 21, for World-Wide Guide.**

Specifications for oil-field engines

. . . booklet contains five pages of condensed specifications for diesel and natural-gas engines. The new 12-page publication contains specifications for hoisting, pumping, and drilling duty, as well as engine-converter, marine, and electric-set data. **Contact Manufacturer: Engine Div., Caterpillar Tractor Co., Peoria, Ill., for Booklet 20257.**

Automatic drilling control

. . . which maintains desired weight on the bit is described in eight-page Bulletin 507. The new publication tells how the Model 6 Micromatic drilling control operates and points out advantages in use. **Contact Manufacturer: National Supply Co., Two Gateway Center, Pittsburgh 22, for Bulletin 507.**

OUTSELLS THEM ALL!

HERE'S WHY

1 2½ to 1 ratio – guide length to guide diameter—prevents galling and hanging up.

2 High thermal expansion rate of sleeve guide and low thermal expansion rate of hardened stem retainer eliminates binding and galling even at elevated temperatures.

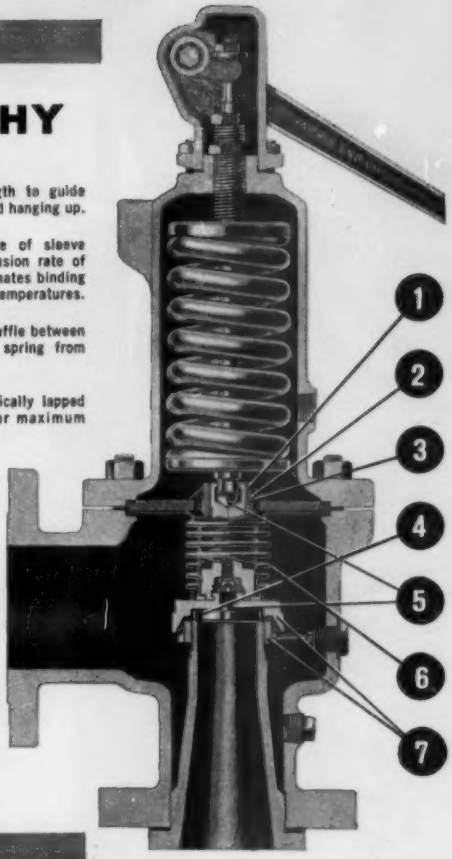
3 Sleeve guide provides solid baffle between body and bonnet, shielding spring from lading fluid.

4 Hardened stainless steel optically lapped flat disc – self aligning for maximum tightness.

5 Double universal ball joint from stem to disc for self alignment – eliminates effects of spring, temperature and piping distortion.

6 Stainless steel "BALANSEAL" bellows nullifies effect of back pressure and isolates internal working parts from lading fluid.

7 Cone-shaped disc holder directs flow away from guiding surfaces and forms fixed secondary orifice with single blowdown ring control for built-in capacity.



Farris full nozzle Safety-Relief Valves

Simplicity in design, safety in operation . . . what more can you ask of a Safety-Relief Valve! The patented design features shown in this Farris valve have been *standard* for more than a decade. It's the ideal concept of a trouble-free, safe, safety valve, free from inventory and design change problems since 1945. It's the *preferred design* in full nozzle safety-relief valves for the process industry.

Detailed information for the selection and sizing of all Farris process safety-relief valves is in Catalog FE-118. Sent to you on request.

Farris ENGINEERING CORP.
527 Commercial Avenue, Palisades Park, N.J.
Texas Plant: 5405 Clinton Drive, Houston 20

affiliates: FARRIS FLEXIBLE VALVE CORP. • FARRIS PICKERING GOVERNOR CO., INC. • FARRIS ENGINEERING LTD., LONDON, ENGLAND

Now...J&L adds
J.L
SUPPLY
ROCKWELL-Nordstrom VALVES
another fine product by
ROCKWELL

Nordstrom Plug Valves!

Yes, your J&L Supply man now has *Rockwell-Nordstrom Lubricated Plug Valves.*

Rockwell-Nordstrom builds tomorrow's valves today to fill your every valve need. Their nationwide sales and service organization is available to assist you with your valve application and service problems.

Rockwell-Nordstrom Lubricated Plug Valves do away with troublesome exposed seats, bonnet cavities, stem breakage and restrictions to the direction of flow.

As a J&L customer you will benefit from *Rockwell-Nordstrom* research. Each factory has its own research laboratory. In addition, *Rockwell-Nordstrom* maintains a Central Research and Development Center staffed with eminent specialists in various scientific fields.

Your J&L Supply man has more information for you on *Rockwell-Nordstrom Lubricated Plug Valves.* Reference literature is available immediately. See your J&L Supply man for "the best available" in lubricated plug valves.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available

76

EQUIPMENT MEN

Baroid transfers J. K. Meagher

. . . from Dallas to Houston as sales representative in the lower Texas Gulf Coast area. Replacing him as sales representative in Dallas is N. S. Wood, who previously worked with Baroid at Calgary.

Holy, Adger are elected to board

. . . of directors of Milwhite Mud Sales Co. at a recent meeting in St. Louis.

Ernest Holy is administrative vice president, and Sidney A. Adger is vice president of public relations and sales.

Ernest Holy

Sidney Adger

The announcement comes from George E. Conner, Milwhite's executive vice president. Milwhite is a division of Mississippi River Fuel Corp., of St. Louis.

Union Pipe & Supply Co. named

. . . a distributor for the complete line of water and oil-well drills, parts, and tools manufactured by Bucyrus-Erie Co., Drill Division, Richmond, Ind. The Owensboro, Ky. distributor will cover the areas of western Kentucky, eastern Tennessee, southern Indiana, and southern Illinois.

Los Angeles Chapter of Nomads inducts new members

Shown between Ritual Master Taylor Bannerman (left) of Technical Oil Tool Corp., and Assistant Ritual Master Lee Laird (right) of Ladish Co., are six new chapter inductees. From left are John Cochran of Driltrol, regular; Neal Thompson of Ken Corp., regular; Louis Smith of Chiksan Co., regular; Bob Thompson of Servco Corp., associate; Joe Douglass of Gardner-Denver Co., regular; and Clayton Rose of Monarch Engineering Co., regular.

Chiksan Co. acquires Hamer

. . . producers of plug, gate, and line-blind valves. The announcement was made jointly by L. S. Hamer, founder and president of Hamer Valves, Inc., Long Beach, Calif., and H. J. Hagn, president of Chiksan.

According to officials of both companies, the transaction will benefit Chiksan in rounding out its product lines in the petroleum and chemical industries, and will provide Hamer with a broader marketing organization.

Ka-cy Mfg. Co., Inc. is formed

. . . in Houston by W. L. Childs and C. B. Kluppel. The new firm combines the experience of many years in designing, fabricating, machining, and sales of pump and compressor units for the petroleum, natural gas, chemical, and other industries.

Francis N. Harris joins

. . . the production-improvements section of Halliburton Oil Well Cementing Co. as staff engineer, chemical services. He had been a member of the analytical section of Howco's chemical research and development labs at Duncan, Okla. He began with the company 13 years ago.

F. N. Harris

The production-improvements section is headed by W. E. Hassebroek, former technical supervisor for fracturing. The production improvements section now includes technical development and coordination responsibility for Halliburton's fracturing, hydrosonic, and chemical services.

Four plants of National Supply

. . . will take on additional operations as a result of a decision to close the company's plant at Toledo. Plants involved are in Gainesville and Houston, Tex.; Torrance, Calif.; and Ambridge, Pa.

E. G. Unrath, vice president of manufacturing, said the changes will bring operations closer to large num-

H. C. SMITH OIL TOOL CO. EXECUTIVES shown at the firm's booth during the recent I.P.E. are: E. Kunnemann, Mid-Continent regional sales engineer; H. G. Bentson, chief engineer, sales; A. S. Marshall, vice president, sales; and Carl Lohman, district sales manager. Other company representatives attending were: K. H. Swart, vice president, engineering; F. E. Siever, Mid-Continent sales manager; M. Martin, foreign sales representative; W. Brant, Northwest regional sales manager; C. Holt, Southeast regional sales manager; M. Evers, division sales manager; E. Griffin, Southwest regional sales manager; W. R. Faulk, West regional sales manager; J. Bouterse, West regional sales engineer; W. Curlee, administrative assistant to the vice president of sales; and J. E. Sayers, manager of Canadian operations.

WIDE OPEN for Fast Wiring and Inspection

NEW complete line of low voltage motor control

Wide-open accessibility and modern design assure fast and easy installation, modification, inspection and maintenance of this new line of Size 0 through 4 Allis-Chalmers control. For instance, large and clearly marked terminals, pressure connections for all wiring, wide and deep-cut screw slots, clearly visible contacts, easy coil replacement, readable rating plates, "out-front" overload relays.

Flexibility

This new line of control permits making many modifications in the field with ease. Minimum parts requirements facilitate delivery from local stock.

Unsurpassed Mechanical and Electrical Life

Millions of "life-test" operations attest to the functional quality in every detail — assure the ultimate in dependable performance and sure protection for personnel, motors and machines.

A complete line of low voltage control (Size 0 through 8) and high voltage control *in all NEMA* enclosures, plus engineered control systems. Your A-C distributor or representative will give you all the details. *Or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.*

Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS A-C ALLIS-CHALMERS

A-5984

HUDSON Combin-aire

LOW TEMPERATURE COOLING USING COMBINATION OF MINIMUM WATER AND MAXIMUM AIR

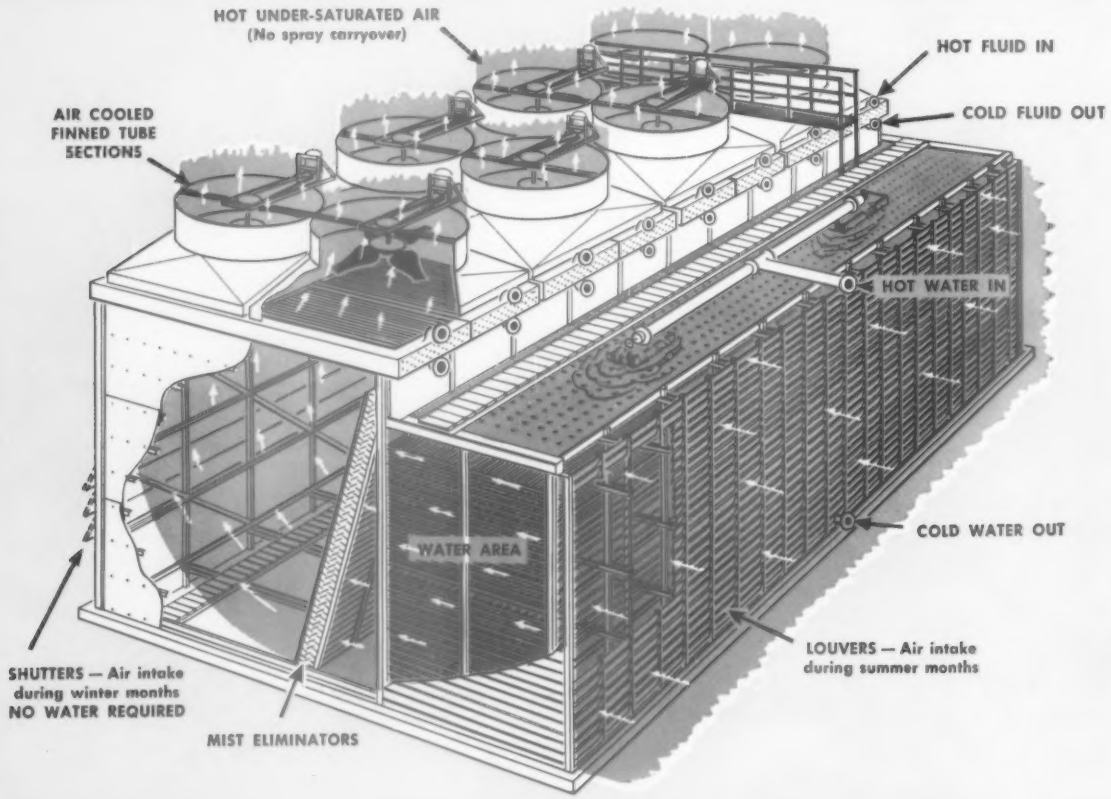
In recent years Hudson Solo-aire cooling in which only air is used as a cooling medium has been installed by the world's largest refineries. In recent cases of three separate 40,000 barrel complete refineries in locations where unlimited water is accessible Hudson Solo-aires are used for *all* process cooling.

So that air could be used for cooling those process streams requiring lower terminal temperatures than obtainable with ambient summer air temperatures, Hudson developed and in 1949 installed the first Combin-aire cooling unit. Since that time Combin-aires have proven their worth in installations for over 80 services in major refineries, chemical plants and gas processing plants in the United States, the Middle East, Europe, Mexico and South America.

In Combin-aire cooling, high temperature ambient air is first pre-cooled by direct contact with water, the cooled air then becoming the low temperature cooling medium for fin-tube elements. Cooling of air, and subsequent use of the cooled air for fin-tube cooling of process streams, are effected in one integrated structure — the Combin-aire.

Cooling with Combin-aire to overcome the occasional limitation of high ambient temperatures has the following advantages:

- **Absolute minimum water consumption consistent with attainment of low terminal process stream temperatures.**
- **Water circulation may be made automatically responsive to air temperatures with no water circulated except at high ambient temperature.**
- **No water treatment necessary. Salt water or brackish water may be used.**
- **No spray carryover or condensation. After passing across the fin-tube elements the heated air leaving the Combin-aire at elevated temperature is undersaturated with water vapor and cannot precipitate condensate or carry water spray.**
- **Minimum piping. Combin-aire may be installed immediately adjacent to other process equipment.**
- **Clean air to fin-tube units. During the hot season air is washed, removing dust, sand and insects.**


HOT UNDER-SATURATED AIR
(No spray carryover)
HOT FLUID IN
COLD FLUID OUT
AIR COOLED FINNED TUBE SECTIONS
HOT WATER IN
WATER AREA
COLD WATER OUT
LOUVERS — Air intake during summer months
SHUTTERS — Air intake during winter months NO WATER REQUIRED
MIST ELIMINATORS

When Combin-aires are installed as adjuncts to cooling systems using existing shell and tube or other water cooled equipment the cooled water from the bottom of the Combin-aire may be used in such equipment. The Combin-aire then takes on the additional function of a water cooling tower with, however, the advantages over conventional cooling towers of dual use of both air and water and elimination of water spray carryover and condensate precipitation.

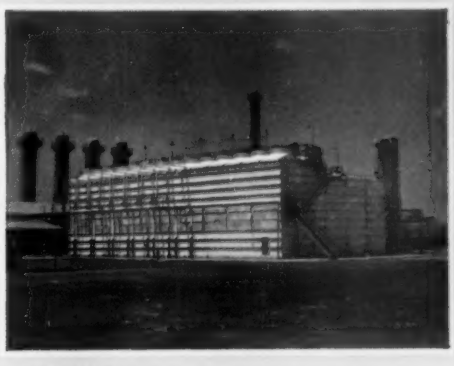
In over 80 services and under a wide range of atmospheric operating conditions Combin-aire units have amply fulfilled performance and mechanical specifications. Before proceeding with a new process unit or revamping or adding to present cooling systems let Hudson give objective assistance in determining the most economic balance in the use of air cooling, Combin-aire cooling and water cooling.

CONVERTING COOLING TOWERS INTO COMBIN-AIRE UNITS

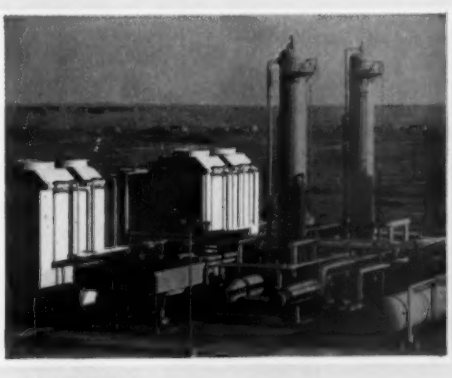
Presently installed cooling towers may be used as the basis for Combin-aire cooling by installing structure with fin-tube elements and fans immediately adjacent to the cooling tower with air for the fin-tube elements being drawn across the water near the bottom of the cooling tower, thus increasing the capacity of the cooling tower, and cooling the air for use in the fin-tube elements.

Combin-aire is protected by U. S. Patents, Patents pending and copyrights.

TEXAS —
COSDEN PETROLEUM CORPORATION
Big Spring, Texas



MEXICO —
PETROLEOS MEXICANOS
Reynosa, Tamaulipas, Mexico



PAKISTAN —
PAKISTAN PETROLEUM, LTD.
Sui gas field, West Pakistan

HUDSON
ENGINEERING CORPORATION
FAIRVIEW STATION • HOUSTON, TEXAS

SALES OFFICES:
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17 Stratton St., Picadilly London W. 1, England • Corrientes 1115 Buenos Aires, Argen. • Rua Mexico 43 Rio de Janeiro, Brazil
HUDSON COOLING EQUIPMENT MANUFACTURED UNDER LICENSE BY:
A. F. Craig & Co., Ltd. Paisley, Scotland • Batignolles-Chatillon 5 Rue de Monttessuy Paris, France

10,000-ft tapered string of Type 43 rods starts fourth year in Dennis-Gowdy

January, 1959 started the fourth year of steady service for a tapered string of Bethlehem Type 43 rods in the Dennis-Gowdy Well in the North East Purdy Field, near Lindsay, Oklahoma. The string consists of 5,600 ft of ¾-in., 2,300 ft of ⅞-in, and 2,100 ft of 1-in. rods. There have been no rod failures to date.

Operated by Magnolia Petroleum Company, the Dennis-Gowdy is one of the deepest producing wells in the N.E. Purdy Field. This is a dual completion, pumping from the Springer and flowing from the Hart. The pumping unit operates at 6 spm, using a 100-in. stroke.

NO BENT OR KINKED RODS WITH BETHLEHEM PACKAGE

Bethlehem Sucker Rods come bundled in a unit package of 80 or 100 rods. Grooved steel spacers cradle rods, protect them from damage during shipment and handling. Package can be lifted easily, thus saving handling time.

The Bethlehem Type 43 rod is a high-strength rod, made of nickel-chromium-molybdenum steel. It is normalized and tempered, and is recommended for extra-heavy loads in wells which are effectively inhibited against corrosion.

In addition to the Type 43 rod, Bethlehem produces three grades of carbon and alloy rods to enable operators to meet a wide range of pumping requirements.

If you have any question about which type of rod would be most economical for any given well, talk it over with your Bethlehem sucker rod distributor. Or drop a line to the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

bers of oil-field customers. Transfer of machinery from the Toledo plant will begin September 1 and will be completed by the end of the month.

Arvid H. Edwards is appointed

. . . advertising manager of Black, Sivalls & Bryson, Inc., manufacturers of oil-field equipment, control valves, and steel products. Edwards, a member of the BS&B's advertising staff for 11 years, has worked in every area of the company's promotional activity. Early last year he was named assistant advertising manager.

A. H. Edwards

John H. Boetjer has been named advertising supervisor, controls division. He had been supervisor of publications. J. D. Hughes will serve as advertising supervisor, steel-products division, moving up from the publications section of the department.

Lukenheimer Co. opens offices

. . . at Los Angeles and San Francisco.

The Los Angeles facility will serve as headquarters for Newton R. Crum, the company's California manager. The San Francisco office will be

N. R. Crum

L. L. Bradford

headquarters for Lawrence L. Bradford, Northern California representative. Sales representatives L. Allen Barth and Robert A. Miles share the firm's Southern California-Arizona territory.

Hughes Tool Co. makes awards

. . . in the form of scholarship grants to eight students who will attend southwestern colleges in September, reports Dr. Daniel J. Martin, Hughes' vice president, engineering. Awards were given in the areas of mechanical engineering and design and drafting.

Martin said the basis for selection for the mechanical-engineering award was on interest and ability of the candidates in the design field of mechanical engineering as applied to product and production engineering.

The design and drafting award is made for interest and ability in the

HYCALOG

Developed by Hycalog . . .

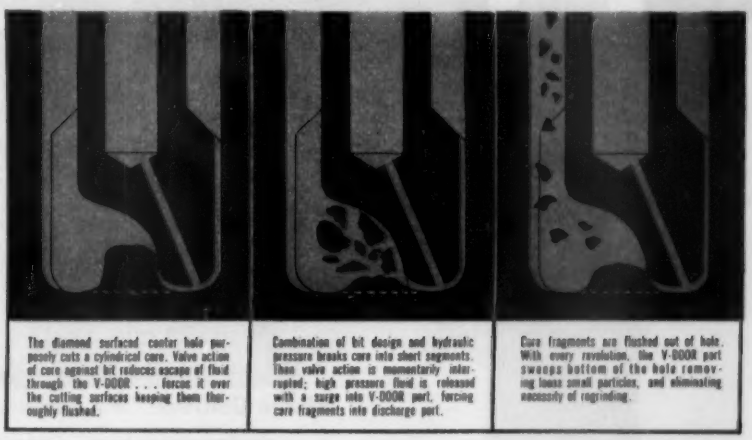
V-DOOR DRILL BITS PATENT PENDING
CORE AND BUST TO ACHIEVE LONG UNINTERRUPTED RUNS

Diamond drill bits were formerly handicapped in duration of runs . . . *and rate of penetration* . . . by their inability to dispose of cores formed at their centers.

In shales and other soft formations, the core twisted off and rotated with the bit.

In hard sands the core crushed the center diamonds, preventing further drilling.

BUT HYCALOG'S ENGINEERS have turned these handicaps into an advantage. Now, the V-DOOR bit, developed by HYCALOG, utilizes *controlled failing* of cores to achieve a faster rate of penetration . . . *and longer life.* HERE'S HOW:


The diamond surfaced center hole purposely cuts a cylindrical core. Valve action of core against bit reduces escape of fluid through the V-DOOR . . . forces it over the cutting surfaces keeping them thoroughly flushed.
Combination of bit design and hydraulic pressure breaks core into short segments. Then valve action is momentarily interrupted; high pressure fluid is released with a surge into V-DOOR port, forcing core fragments into discharge port.
Core fragments are flushed out of hole. With every revolution, the V-DOOR port sweeps bottom of the hole removing loose small particles, and eliminating necessity of regrinding.

Ask your HYCALOG rep to show you some performance records on the V-DOOR. He has a stack of them. *And also get the facts on* HYCALOG *well logging.*

Hycalog, Inc.
505 AERO DRIVE
SHREVEPORT, LOUISIANA

BRANCH OFFICES IN PRINCIPAL OIL PRODUCING AREAS

DIAMOND CORING • DIAMOND BITS • WELL LOGGING • CORE ANALYSIS

Companion to the Proved E-Z Swab, the new Mark I Cup Swab uses the same mandrel but different rubbers. Mark I is a heavy duty positive displacement type swab able to lift a fluid load of from 1,200 feet to the heaviest loads encountered. Mark I was designed for use where the unique features of the E-Z Swab are not required. Heart of the Mark I—see cutaway—is a solid steel reinforcing core. This solid steel core can't wear, bend, and break as conventional reinforcing wires can. Can't hang up in tubing the way wires can. The new Mark I falls fast and comes out full. All this and the famous Mission Guarantee: "In a competitive test it will outperform all others or your money back." Order through your favorite supply store. Get your copy of the new brochure.

PATENT PENDING

Nothing but the finest will bear the name of MISSION MANUFACTURING CO.

MISSION MANUFACTURING CO., P. O. Box 4309, Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
In The United Kingdom: MISSION MANUFACTURING CO., LTD., 17 Hanover Square, London, W. 1 England • Cable Address—"Missmen"

PISTONS • PISTON RODS • SLIPS • GLAND PACKINGS • LINERS • LINER PACKING
PUMP VALVES AND SEATS • SWABS • VALVES • HAMMERDRILS • CENTRIFUGAL PUMPS

field of industrial drafting as applied to product development and manufacture.

Horace G. Trainer is appointed

H. G. Trainer

. . . general sales manager of Cleveland Diesel Engine Division, General Motors Corp., by Thomas E. Hughes, the division's general manager. Trainer succeeds K. O. Keel, who is retiring after 40 years' service. Trainer joined the division in 1934. He served as representative and sales-application engineer until being named executive engineer in 1957. He was appointed assistant general sales manager later the same year.

Thompson is named manager

Wayne Thompson

. . . of Tuboscope Co.'s West Texas division, according to Bill E. Thomas, the firm's marketing manager.

Wayne Thompson worked in West Texas as division sales manager and assistant division manager before his promotion. He joined the company in 1952 as an operator, and went into sales 3 years later. Thompson makes his home in Odessa, Tex.

NEW OFFICERS of the Natural Gasoline Supply Men's Association taking office at a recent board meeting in Dallas are, seated, from left: President R. P. Walker, Minneapolis-Honeywell Regulator Co., Oklahoma City; Retiring President H. O. Sears, Alliger & Sears Co., Houston; and Vice President Ray Riddle, Riddle & Hubbell Co., Tulsa. Standing, left to right, are: Secretary W. F. Lowe, Tulsa; Vice President E. O. Haltom, Trinity Steel Co., Dallas; and Treasurer C. P. Stanley, Dresser Engineering Co., Tulsa.

Lester Farley joins

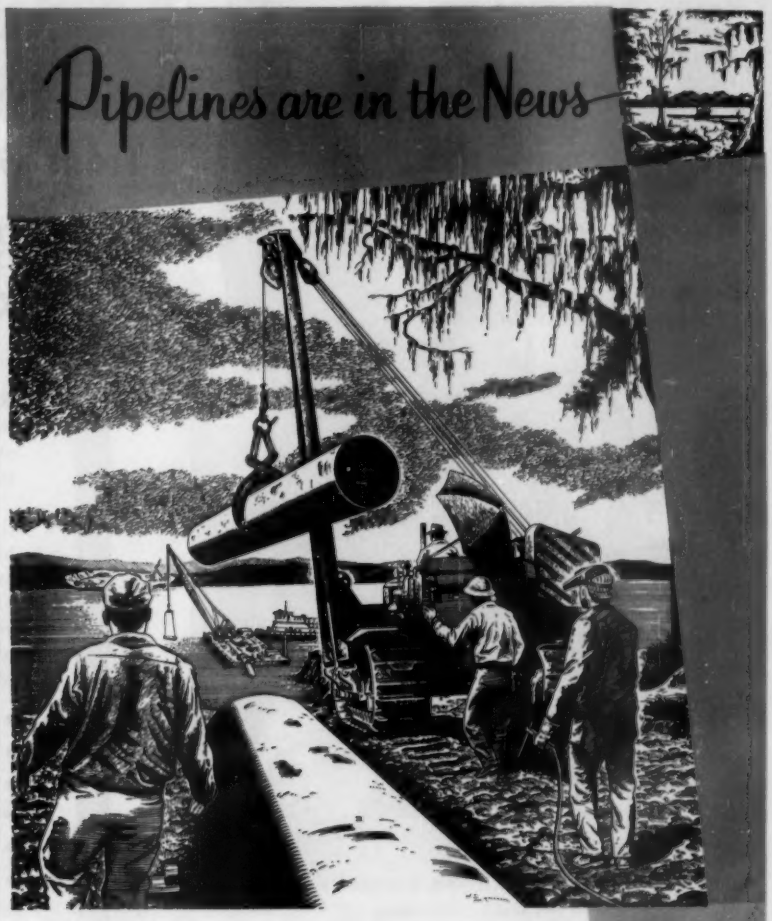
. . . Tyson Smith Co. as a sales engineer, according to Jack C. Norton, sales manager. Farley will cover San Antonio, Victoria, and surrounding areas from the Corpus Christi sales office. Farley previously was with Halliburton Oil Well Cementing Co., Gulf Coast Machinery & Supply Co., and Rolo Mfg. Co.

Meanwhile, L. M. (Matt) Bracewell, Tysco sales engineer, has been transferred from the Lafayette-New Orleans area to Dallas. Walter W. Kincaid has also been named sales engineer with Tysco. He will work the Beaumont area. Kincaid formerly was with Gulf Oil Corp. in Beaumont.

Thornhill-Craver Co. conducts

. . . a filtration demonstration at the company's Reno, Nev. terminal to show how ultra-fine particulate matter can be removed from aviation fuels by using filter aid in conjunction with jet-type self-cleaning strainers.

In six sample batches of JP-4 jet fuel analyzed, the undissolved solids



Watch . . .

WILLIAMS BROTHERS

New York
Washington — Pittsburgh — Louisville
Minneapolis — New Orleans — Caracas
Bogota — La Paz — Edmonton
Calgary — London — Ankara — Tehran

OIL
GAS
WATER
PRODUCTS
PIPELINE
SYSTEMS

ENGINEERS-CONSTRUCTORS
NBT BUILDING TULSA, OKLAHOMA
CABLE ADDRESS: WILLBROS

To save time . . .
Every Tool Box Needs
a compact, easy-to-carry

RIDGID®

Drop Head Threader Set

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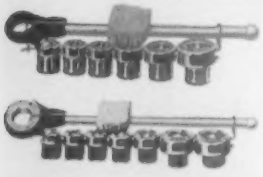

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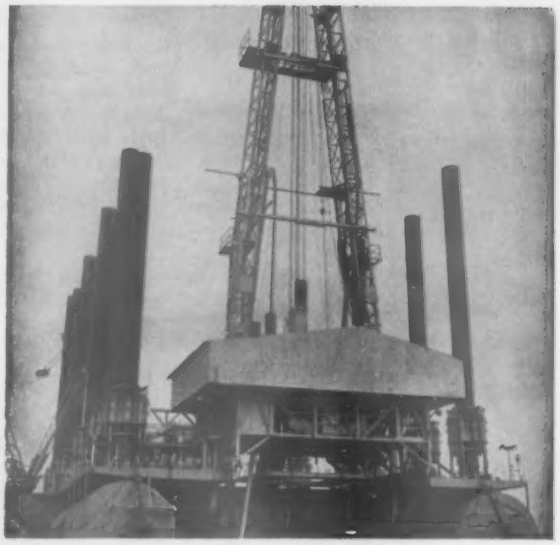

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in the incoming stream ranged from 1.6 to 14 mg/liter. After filtration, the undissolved solids dropped from 0.4 to 1.0 mg/liter. There was no diatomaceous earth in the filtered samples and no adverse effect on the chemical qualities of the jet fuel.

A copy of the report may be obtained by writing to Thornhill-Craver Co., P. O. Box 1184, Houston.

John N. Donhaiser joins

J. N. Donhaiser

... Houston Oil Field Materials Co. as coordinator of research and development, announces Hugh Q. Buck, president. Before joining HOMCO, Donhaiser worked as a field engineer and division mechanical engineer for Pure Oil Co., and as assistant manager and chief engineer for Coastal Marine Drilling & Construction Corp. While employed at Coastal Marine, he directed and supervised the design of various offshore units.

In 1959, Donhaiser established practice as an independent consulting engineer and was retained by Pan American International Oil Co.

Rolo promotes V. E. Smith

V. E. Smith

... to sales manager. Smith has been with the Houston manufacturing company for 2 years. Before that he was the company's representative in South Texas.

Other Rolo promotions include P. A. Clower to assistant sales manager, and J. L. Kepple to assistant to the president. Clower has been with Rolo 7 years in the sales and engineering departments in Houston.

Kepple is an 11-year company veteran. In addition to his duties as assistant to the president, he will continue as secretary-treasurer of the corporation.

Garrett Oil Tools announces

... the appointment of C. M. Peters as vice president in charge of sales engineering, in which position he will be in charge of operations in Europe and the sterling-currency areas. Peters has served with Garrett and its predecessor companies since 1938, and has held the position of vice president, engineering since 1956.

At the same time, Garrett also announced that V. B. Scott has been named manager of product development, with responsibility for the activities of the firm's engineering department and special projects. Scott has served with the company since 1953 as assistant sales manager and, most recently, manager of special projects.

Two other staff changes include the appointment of B. A. Abercrombie to administrative engineer, product testing and evaluation, and F. L. Magoon to administrative engineer, research and development.

Republic Supply Co. announces

... the addition of C. J. Grevemberg who will assume duties as manager of the New Orleans sales office. Grevemberg joined Cameron Iron Works in Houston in 1936 before going into business for himself in oil sales at Lake Charles, La.

He later became purchasing agent for Production Service Co. in Houston. In 1950 Grevemberg returned to Cameron and was city sales representative at the time of joining Republic.

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Only the BAKER Packer does so many jobs so well!

Thousands of varied applications throughout the world are proof of the versatility and performance of this most widely-used drillable production packer.

The basic design has been continually improved to withstand higher and higher temperatures, record-breaking depths and pressures. It has kept pace with the need for more complex multiple completions... yet it is these long-proven, basic features which contribute so largely to its versatility and usefulness...

- *Holds high pressure differentials from above or below—even under temperatures in excess of 300°F.*
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In Argentina, over Texaslike prairie . . .

Past curious villagers . . .

American drillers move to well site

DESTINATION for Loffland men and equipment—a small port far down Argentina's Atlantic coast, a 9,000-mile voyage (comparable to the distance from Houston to Moscow to the east or from Houston to Tokyo to the west.)

Mission—tapping Argentina's rich oil deposits in a 1,545-sq. mile area in the Comodoro Rivadavia vicinity for Pan American International Oil Co. of New York. Loffland Brothers was contracted to drill at least 50 wells in the area in 1959 as part of Argentina's over-all petroleum recovery program.

Gathered in Houston was the largest fleet of mobile drilling rigs ever assembled under the operation of one contractor. More than 300 suppliers were brought into the gigantic massing. The total inventory consisted of 10 new and complete drilling rigs and all the necessary accessories to put the rigs to drilling. All equipment being used in the Argentina operation is coming from this country.

Original plans called for the three ships to dock at Comodoro Rivadavia, a port 1,000 miles south of Buenos Aires. Comodoro Rivadavia is a port with adequate unloading facilities. Because of the possible wind damage to ships and drilling equipment at Comodoro Rivadavia, however, the alternate port in the plan, Puerto Deseado, was used. Puerto Deseado

Source: "Drilling Is Our Business," Loffland Brothers Co., Tulsa.

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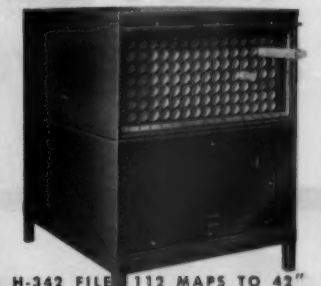

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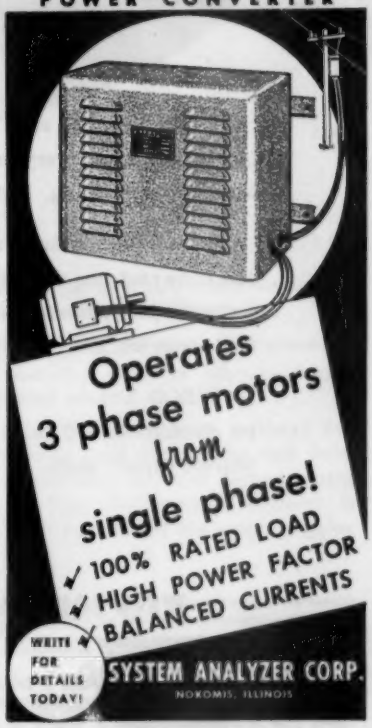

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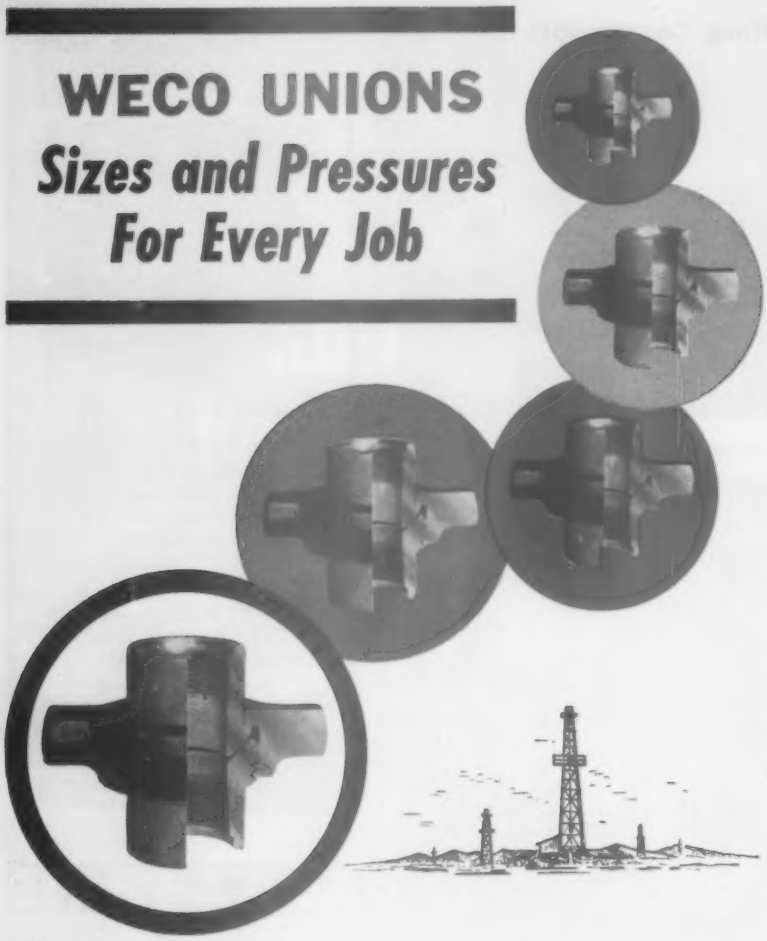

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is a port up a river 10 miles from the coast. The inland dock afforded some protection from the blowing winds for which this part of the world is so well known. Winds have reached a 135-kilometers per hour velocity.

Primarily a port for the exporting of wool, Puerto Deseado did not offer the unloading facilities that would have been available to Comodoro Rivadavia. Puerto Deseado had only one crane. The crane proved to be too small to be of help in the unloading.

The dock at Puerto Deseado was only 261 ft. long. The Dorian, the third ship in the operation to dock, is 640 ft. in length, over two times the length of the entire dock. Port officials reported that the Dorian was the largest ship ever to dock at Puerto Deseado.

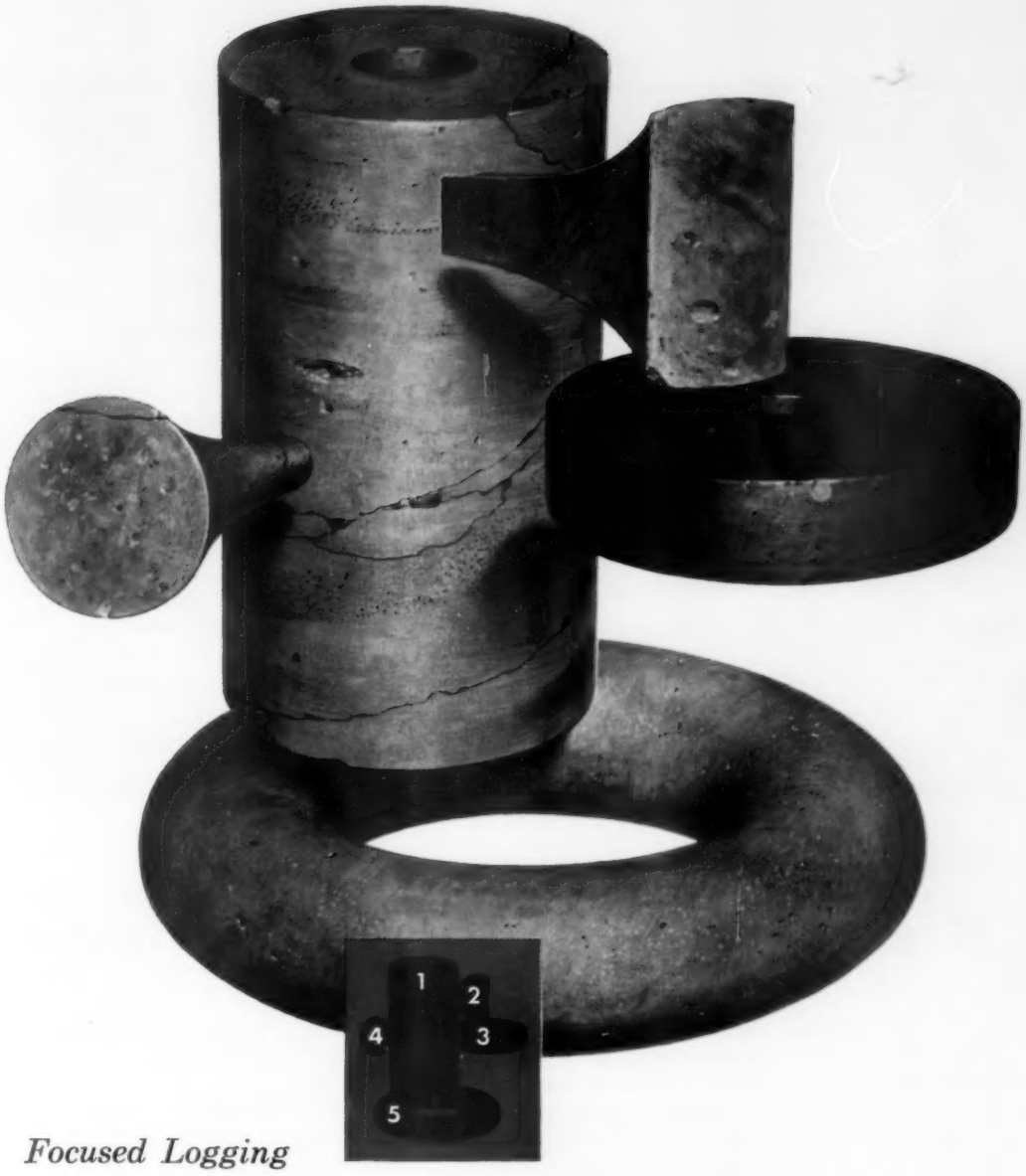
Stevedores at the port had no tools for the unloading of the ship or the unpacking of the crates. Having worked only with the exporting of wool, the stevedores were not at all accustomed to handling equipment of such a tremendous size and weight. Men from the ships had to hurriedly train the stevedores to manage guy ropes and the large heavy machinery. The ship's tackle and manned guy ropes proved to be an adequate means for the unloading.

The unloading of the larger equipment from the ships took about 5 days, and long days at that. The ships arrived during the Argentina summer, December and January. Lying about as far south from the Equator as Quebec, Canada, lies to the north, daylight in the summertime lasted about 20 hours a day. The sun was rising between 3 and 4 a.m. and setting between 10 and 11 p.m. As long as there was daylight, the unloading continued. The summertime temperature for the area remains in the 50's.

The biggest problem faced in the drilling operation is the need for water. Drilling actually had to be delayed several days until the first water well was brought in.

Loffland men live in camps at the drilling sites in small prefab houses. The prefabs, obtained in Argentina, have been built into permanent camp sites for the Loffland personnel.

The first well was spudded in on January 6, 1959. Today, drilling continues. Loffland Brothers men and equipment are meeting the terms of their contract. The largest single foreign operation ever undertaken by an individual drilling contractor has been handled successfully by Loffland Brothers, the world's largest drilling company.



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A decade of research at Schlumberger has produced five Focused Logging Methods. Each, fitted to the right borehole and formation conditions, becomes part of a true oil-finding technique. Your Schlumberger engineer is trained and qualified to recommend the proper logging program for your well.

The artist's concept of the patterns of Schlumberger Focused Logging is represented by sharply sculptured sections lifted from the formations surrounding the borehole. (1) Sonic Log (2) Proximity Log (3) Laterolog (4) Microlaterolog (5) Induction Log.

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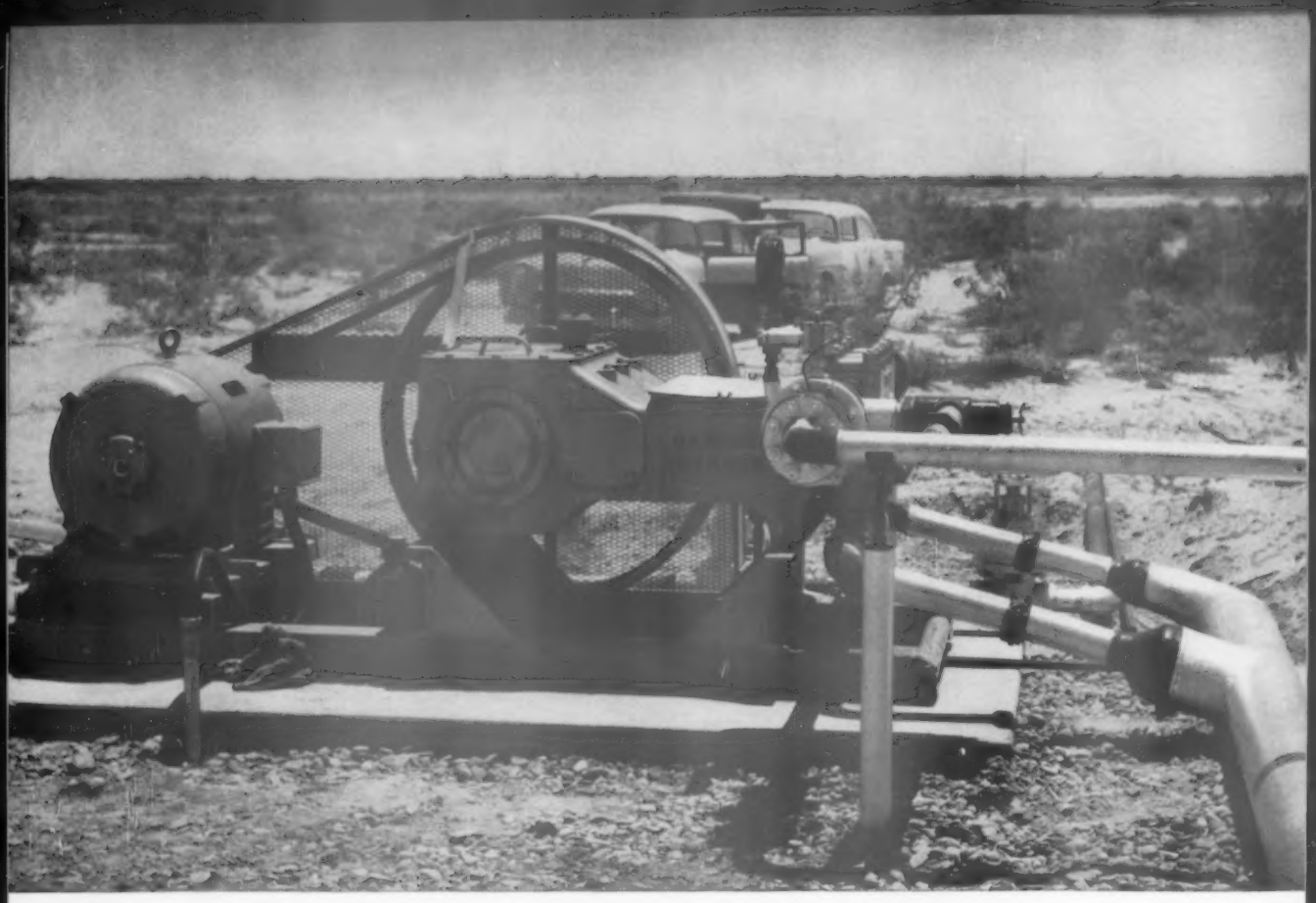

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You get *more* than just a motor from Century Electric—you get motors matched to your equipment, plus one that's built for *long* life. For more information contact your nearest Century Electric Sales Office or your supply store.

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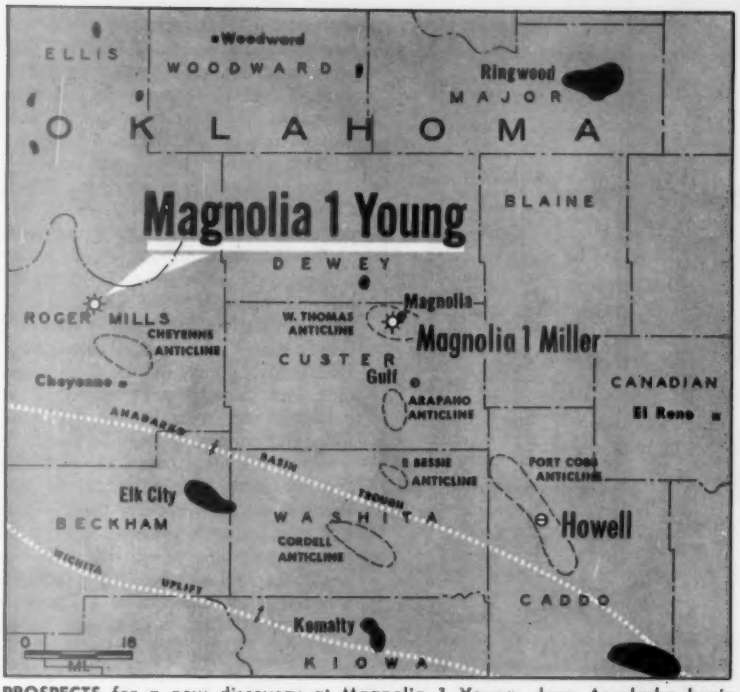


PROSPECTS for a new discovery at Magnolia 1 Young, deep Anadarko basin wildcat, continued hopeful last week despite failure of one Pennsylvanian drill-stem test. The well is being drilled deeper, to 15,000 ft., in search of several other possible pays in Mississippian, Devonian, and possibly Ordovician.

Oklahomans eye Anadarko wildcat as key test

BY FRANK J. GARDNER

MAGNOLIA PETROLEUM CO. is fast emerging as the wildcatter of the year in the Southwest. During the past 3½ months, this aggressive company has consistently made headline news with important discoveries in remote places.

It was in April that Magnolia announced success at its 1 Miller, Section 22-15n-16w, Custer County, Oklahoma. This important gas strike gave Oklahoma an entirely new producing county; it opened the second-deepest Siluro-Devonian production on the continent (at 14,383-14,472 and 14,773-14,818 ft.) and the second-deepest production in Oklahoma. It was also the second discovery of a Hunton reservoir in the vast Anadarko basin. At the time, this column referred to the 1 Miller as Oklahoma's discovery of the year and hailed it as the opener of a new era in Anadarko exploration. (OGJ, April 20, 1959, p. 169).

Today, Magnolia is threatening to repeat the performance. In a closely watched wildcat operation at the 1 Young, Section 3-15n-24w, we may be witnessing the debut of yet another dry county into the Oklahoma production column. This well lies in north central Roger Mills County, a sparsely drilled area, and last nonproductive county in the entire Anadarko basin.

Tests fail . . . At the moment, the Young well looks a little disappointing, after having indicated a possible discovery in the Deese-Pennsylvanian section between 11,564 and 11,632 ft. Magnolia set casing on bottom at 11,674 ft. and made two sets of Deese perforations (11,626-32 ft. and 11,564-11,626 ft.)

On a 7½-hour test of the lower set, with packer at 11,576 ft., gas surfaced in 20 minutes in too small a volume to measure; recovery was 1,000 ft. of water cushion and 630 ft. of gas-cut mud.

After perforating the upper level, tool was left in the hole a total of 39 hours. Here, gas surfaced in 45 minutes (ungaged) and the tool was shut in for 4 hours. Surface pressure registered 1,175 psi. When opened up again, the well flowed a 1,350 ft. water cushion and 1 bbl. of new oil in half an hour. A flow gage of 195 M.c.f. gas per day was taken, plus 12 gal. of condensate per hour.

On the last test of the Deese sand, Magnolia set packer at 11,546 ft. and acidized the section. Swabbing resulted in 1 bbl. of load water in 1 hour. At last report, the packer had been drilled out and the bit was aimed at contract depth of 15,000 ft.

But objectives lie deeper . . . On its way down, the 1 Young has several possible targets in the Lower Pennsylvanian, Mississippian, Siluro-Devonian, and Ordovician. It's doubtful that 15,000 ft. here will reach the Ordovician, but certainly there are potential reservoirs as old as the Devonian in range of the well. For this reason, interest will continue high in the progress of Magnolia 1 Young as it drills ahead. Only five wells in all of Roger Mills County have gone deeper than 10,000 ft., and none has reached 15,000 ft.; the deepest stopped at 14,503 and was 17 miles southeast of the 1 Young, farther into the basin deep.

A Hunton (Siluro-Devonian) strike here would be truly significant. And it's not unlikely. The Magnolia 1 Miller strike in Custer County created a new wave of interest in Hunton potentialities throughout the Anadarko region; a "confirmation" at the 1 Young, 50 miles due west, would probably launch a deep-wildcat campaign throughout the basin. Magnolia is now drilling a northeast offset to the 1 Miller; this is the 1 Carter (Section 15-15n-16w), currently approaching target depth.

Other interesting wildcats in the Anadarko country include the Gulf Oil Corp. 1 Burgtorf, in Section 6-13n-15w, in Custer County, and the Howell, Ellison et al. 1 Anadarko basin, Section 4-9n-12w (see map). Gulf is now testing Pennsylvanian sands at 13,570-ft. level, while the Howell operation is also testing Pennsylvanian at 16,150 ft.

Magnolia 1 Young is the only driller in all of Roger Mills County today. If it should make a well, there'll be many more drilling this time next year. The operator's fingers are crossed.

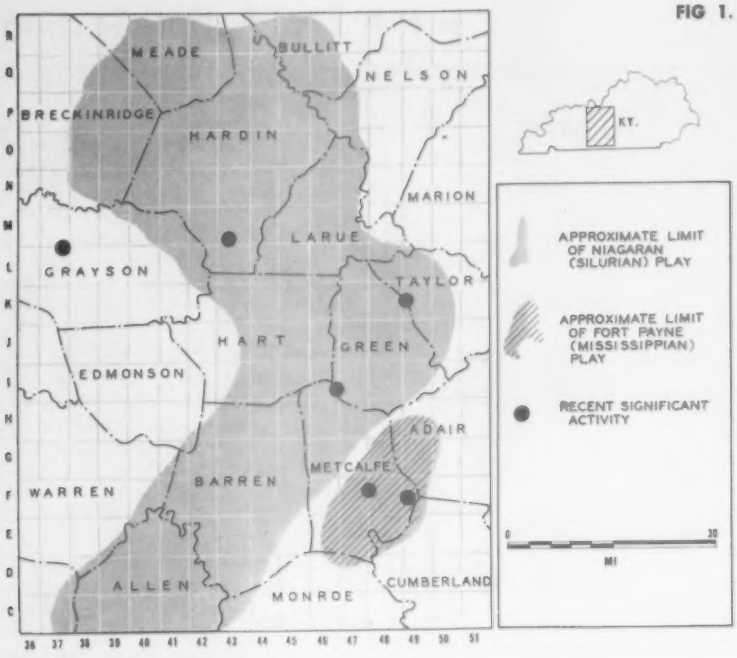


FIG 1.

Green County sparks . . .

500-ft. drilling boom in . . .

Central Kentucky

BY JOHN M. BARNES
Owner, Mid-States Consulting Corp., Evansville, Ind.

THE LAND of race horses, blue grass, and bourbon is rapidly becoming one of the hottest oil spots in the country.

Not since the early 1920's, when the Bowling Green oil boom was in full swing, has Central Kentucky witnessed such frantic leasing and drilling activity.

The reason for the unbridled optimism concerning the productive potential of this area is the discovery of significant new oil reserves at productive depths of less than 500 ft. in Green County, Kentucky.

At present there are approximately 350 rigs drilling in the area, with nearly 200 cable-tool and water-well rigs active in developing the sprawling Green County oil pool. This pool is now nearly 20 miles long and 2 to 3 miles wide.

The field contains approximately 1,500 producing wells within an estimated area of 9,000 acres. It seems probable that the proven area will eventually cover 12,000 to 15,000 acres, and contain as many as 2,500 wells. Ultimate recovery is presently estimated at between 20 and 25 million barrels of oil, or an average of 2,000-2,500 bbl. of oil per acre.

During the early phase of the Green County pool development, many experienced oil operators took one look at the immense amount of salt water being produced with each barrel of oil and refused to be swept up in the speculative fever that presently grips most of Central Kentucky. Eventually, many of these cautious operators joined the throng of inexperienced oil men in the scramble for quick riches.

Now, oil men from all over the country have been attracted to this shallow play. However, this is not just a promoter's paradise. Plenty of money is being made in the area beneath, as well as above, the ground. Reputable oil companies, major and independent alike, have finally joined the horde of farmers and local businessmen who are now reaping the benefits of being the first to enter the wildest oil play in Kentucky's history.

Economics

One glance at productive figures, as well as the relatively low drilling and completion costs, indicates why so many independent and major oil operators are interested in this area.

At present, the Green County pool is producing nearly 45,000 bbl. of oil per day from approximately 1,500 wells. This is an individual well average of 30 bbl. of oil per day. The pool has already accumulated more than 6,000,000 bbl. of oil since it was discovered in the spring of 1958.

Drilling costs average $3.75 per foot and the average oil well costs from $8,000 to $10,000 to drill and complete at productive depths of 400-500 ft.

Average ultimate recovery in the entire pool is expected to reach 2,000-2,500 bbl. of oil per acre, with some of the better leases expected to recover up to 5,000 bbl. of oil per acre. In fact, several large tracts in the older part of the pool have already produced 2,000 bbl. of oil per acre. Average pay thickness in the field is approximately 10-12 ft., with some wells in the Marshall Ridge area, located in the northeastern part of the productive trend, penetrating 20-25 ft. of saturated section.

Widely scattered core analyses indicate an average ultimate recovery

Generalized Columnar Section—Green County, Kentucky

	System	Series	Formation	Thickness	Lithology	Description
0	Mississippian	Meramecian (Middle)	Warsaw	250–200		Limestone, gray to gray-tan, very fine to fine crystalline; abundant chert, gray; scattered intercrystalline porosity, small gas pockets. Interbedded with shale, gray to gray-green calcareous.
100′						
200′		Osagean (M) / Kinderhookian (L)	Fort Payne—New Providence	40–20		Shale, gray to gray-green, calcareous; chert, gray.
	Dev.	(Upper)	New Albany	50–45		Shale, black to dark gray-brown, fissile, pyritic; small gas pockets.
300′	Silurian	Niagaran (Middle)	Louisville (Lego)	60–10		Porosity / Porosity — Dolomite, buff to tan, fine to medium crystalline, calcareous; lenses of intercrystalline and vuggy porosity; OIL AND WATER.
			Waldron	10 - 5		Shale, gray, subfissile, dolomitic.
			Laurel	70–30		Porosity / Porosity — Dolomite, buff to tan, fine to medium crystalline, calcareous; abundant fossile hash; lenses of intercrystalline and vuggy porosity; OIL AND WATER.
400′			Osgood	40–10		Shale, red, green, gray, subfissile, dolomitic.
		Albion (L)	Brassfield	15–10		Porosity — Dolomite, yellow-tan to gray-green, fine-grained and fine crystalline; slightly argillaceous; lenses of intercrystalline and vuggy porosity; OIL AND WATER
470′	Ord.	Cincinnatian (U)	Liberty — Saluda	-25+		Dolomite, brown to tan, very fine to fine crystalline, calcareous.

COLUMNAR SECTION for Green County, Kentucky, shows formations producing oil less than 470 ft. from the surface. Fig. 2.

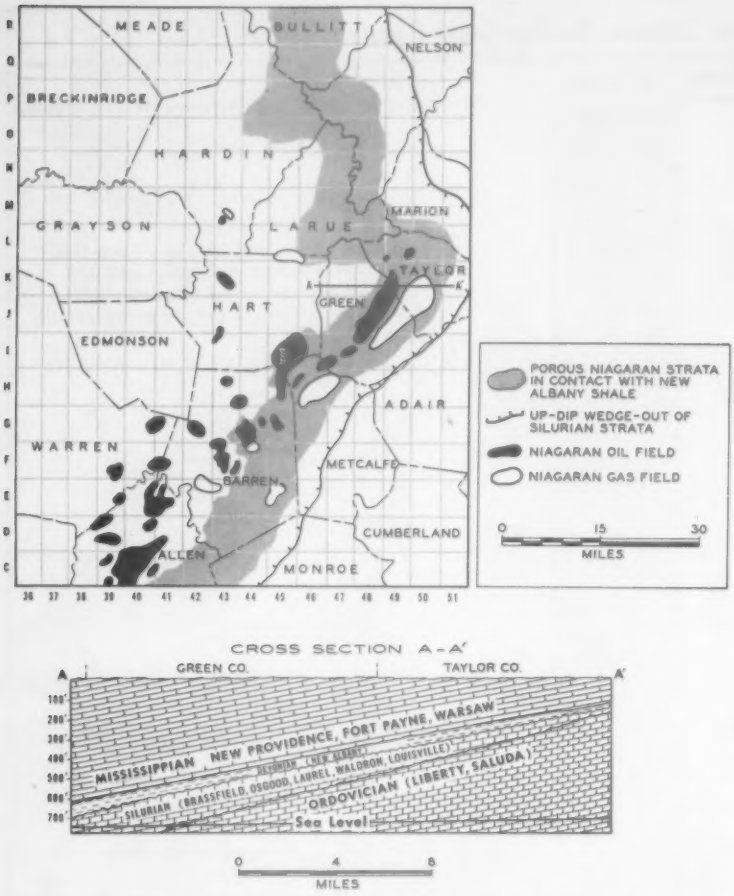
of 180-220 bbl. of oil per acre-ft. Although the average per acre recoveries may not seem spectacular, it should be remembered that at such shallow productive depths, the original investment made in a well in this pool is usually paid out in less than 3 months. Average lease life is estimated at from 2 to 3 years, although some of the better leases may produce for as long as 5 years.

Well spacing in this pool is from ½ to 7 acres, while the average density is one well per 5 acres.

Present price for crude oil in this area, which is purchased by Ashland Oil & Refining Co., is $2.60 per barrel. However, this price is expected to be increased to $3 per barrel by next spring.

Reservoir Characteristics

Principal production in the Green County pool is from lenses of intercrystalline and vuggy porosity within the Laurel formation of Middle Silurian age (Niagaran). The Laurel



NIAGARAN oil and gas fields of Central Kentucky. Fig. 3.

consists of a gray-tan to buff, calcareous dolomite, which contains abundant fossil fragments. Porous zones within this unit which contain oil appear to interfinger with porosity zones containing only salt water. Hence, no clear-cut oil-water contact is discernible in the field.

Oil appears to be produced by solution-gas drive, although a slight water drive may be active in some parts of the pool. Average porosity is 17%, with permeability of 300-2,000 md.

The crude oil produced from these shallow wells is 43°-gravity API.

Minor production is also found in porous lenses of dolomite within the Louisville formation, which is of Middle Silurian (Niagaran) age (see Fig. 2). The lithology of the Louisville and Laurel formations in Central Kentucky is very similar, although in the Green County pool the Laurel is more fossiliferous than the Louisville. This unit contains significant oil reserves in other Niagaran oil pools along the western flank of the Cincinnati arch.

Problems

Most of the wells in the Green County pool produce from 30-95% salt water, creating a serious disposal problem. In order to handle this large volume of water, shallow disposal pits have been dug. Many operators have drilled disposal wells in an effort to satisfy the Kentucky Water Pollution Commission, which is alarmed over the pollution of nearby streams. The salt water is being injected into thin zones above, below, and within the productive interval, with variable effects on oil production in adjacent wells.

Another problem existing in all of Central Kentucky is the lack of regulatory controls over every phase of operations: no drilling permits; no spacing laws; inaccurate well measurements, elevations and locations; few logs run; and generally inexperienced operators. For the most part, the only accurate land maps in Central Kentucky are those which the individual operator constructs himself with the aid of landowners, aerial photographs, and topographic maps.

Geology

Most of the oil accumulations of Central Kentucky occur on minor structural anomalies and within zones of discontinuous porosity. Such is the case in the Green County oil accumulation, which appears to be a stratistructural type oil trap.

The pool is located on a minor structural anomaly along the western flank of the Cincinnati arch, where porosity zones in the westward-dipping Louisville and Laurel formations (Middle Silurian) are truncated and overlain by the New Albany black shale (late Devonian). In Central Kentucky the highest portion of the porosity pinchout is often filled with gas, while oil has accumulated a few miles downdip from the gas field. This general relationship is indicated in Fig. 3.

The Laurel formation (Blue sand) is the principal producing formation of Silurian age in this area. However, the Louisville formation, also of Middle Silurian age, contains significant oil reserves elsewhere along the western flank of the Cincinnati arch.

Fig. 3 indicates the close relationship of Niagaran oil accumulations (Louisville and Laurel) to the zone where porous Niagaran strata are in contact with the New Albany black shale. Usually the Niagaran oil fields are located within, or a short distance downdip from, this contact zone. Undoubtedly further exploration on minor structural folds near, or within, this contact zone will result in the discovery of new oil reserves.

Drilling Activity

With approximately 350 rigs operating in Central Kentucky at this time, new discoveries are almost a weekly event. Furthermore, as development drilling in the Green County pool progresses, more rigs will be released for wildcat drilling in adjacent areas.

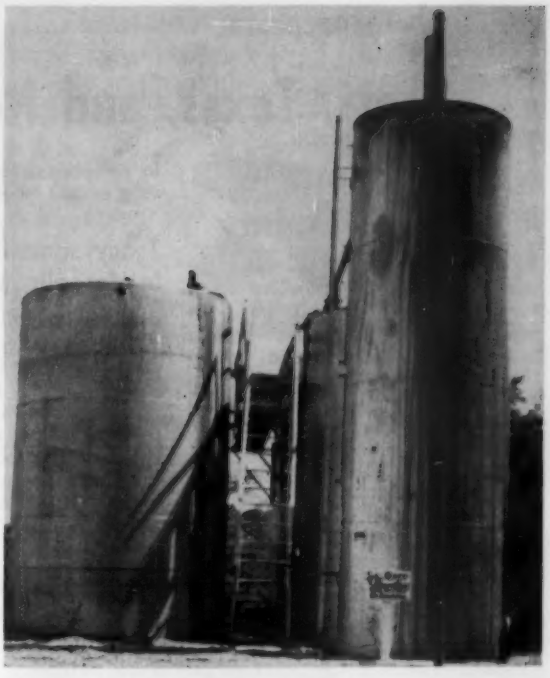
Light spudders are used for drilling. A few rotaries are employed, and some air drilling has been done.

As a rule, operators set 7-in. casing to shut off water flows to depths of 150 to 250 ft. This is set on a shoul-

About the author...

John M. Barnes is owner of Mid-States Consulting Corp., petroleum consultants, Evansville, Ind. He is a graduate of the University of Michigan, holding an M.S. degree in petroleum geology. He was an exploration and production geologist with Carter Oil Co. until 1958.

TYPICAL producer costs from $8,000 to $10,000 to drill and complete.



STORAGE facilities on Associated Drilling Corp.'s T. L. Goff lease.

der, and smaller hole is drilled to total depth. Acidization for completion is the rule, with few exceptions; the usual treatment is about 2,000 gal. per well. Usually, a packer is set with 2-in. tubing, with packer above the Laurel section.

After acidization, tubing and packer are pulled from the hole, and rods and tubing are run in. Pumps are 5 to 7½ hp. electric; gas production is insufficient to run gas engines here.

Recent events . . . Recent Silurian discoveries have been made in southwestern Green County, where initial potentials average 10-15 bbl. of oil per day per well, and in Hardin County near the old Sonora gas field, where oil wells average approximately 35 bbl. oil per day per well.

A Warsaw discovery just west of Leitchfield, Grayson County, Kentucky, recently caused a flurry of leasing in that area. This well had an initial potential of 25 bbl. of oil per day from a depth of approximately 700 ft.

Random leasing and drilling activity has spread southward from Green County into Metcalfe County, with astounding success in the Grissom pool, located a few miles east of Edmonton, Ky. The average initial potential on the 15 wells in this pool is 300 bbl. of oil per day per well. However, a recent completion by the Associated Drilling Corp. in this area had an initial potential of 1,000 bbl. of oil per day pumping and flowing from an estimated 20 ft. of pay.

These wells produce from depths of 250-350 ft. Production is from small vugs in the Fort Payne limestone of middle Mississippian (Osagean) age (see Fig. 2). The Fort Payne in this area is a gray to tan, medium crystalline limestone, with zones of vuggy porosity that contain abundant fossil fragments.

Another recent Fort Payne discovery in eastern Metcalf County has led to frenzied leasing activity in that area. This well is reported to have filled up 135 ft. of clean oil during a 12-hour test at a depth of 251 ft.

Leasing Activity

Concentrated blocks of acreage, as well as checkerboard spreads, are being taken by independent and major operators alike in Breckinridge, Hardin, Larue, Hart, Metcalfe, Adair, Barren, and Allen counties. Most of this acreage has been leased as either a Niagaran or Fort Payne play (Fig. 1). However, recent interest has also been shown in the Devonian possibilities of Warren, Edmonson, Hart, Grayson, and Breckinridge counties.

Many of the leases in Central Kentucky are held by short term drilling commitments. Hence, within the next few months this entire area will experience a tremendous wave of wildcat drilling in order to satisfy lease obligations.

Future Prospects

Highly profitable oil discoveries seem imminent when one considers the present number of rigs drilling for shallow, prolific pays in this area, the absence of proration, and the tremendous amount of wildcat acreage yet to be drilled.

At this time the Fort Payne and Niagaran possibilities appear to be most attractive. However, the middle and lower Devonian strata also appear to have excellent productive possibilities in the western part of Central Kentucky. In short, the future appears to be very bright for this area, which has become the focal point for one of the wildest oil booms in the United States.

Acknowledgment

The author expresses his appreciation to E. Nosow of the Kentucky Geological Survey, Lexington, Ky., for his aid in the preparation of this article.

North Dakota gets new oil discovery

Southwestern North Dakota's first discovery in some time was completed last week by Amerada Petroleum Corp. in Billings County. It is the 1 Logan in NW SE 7-139n-100w, 1½ miles east of Scoria field and the same west of Fryburg field.

The well flowed 176 bbl. of oil in 18 hours on 20/64-in. choke from Heath perforations at 8,155-70 ft. Both Scoria and Fryburg are Heath sand producers. Heath is Mississippian. An offset well is already set at 1 Logan-Gawryluk in NW SE 6-139n-100w, 1 mile north of the discovery well. It will go to 8,300 ft., or Heath sand.

Record long-biting bit

S. W. Jack Drilling Co., Inc., Avonmore, Pa., drilled a total of 6,770 ft. with one bit on its Pennsylvanian rig. The record-setting amount of hole was done with air drilling, using a Reed YC-3 Cobra bit. The 6,770 ft. dug represented the entire 8¾-in. portion of the hole.

Here's what's happening in:

California, Texas, and Nevada

New pay zone in Ventura County

AFTER being out of the news for some time, Bridge pool area of South Mountain field, Ventura County, got back in again in a big way with a new zone discovery turned up by Union Oil Co. of California.

Union tapped the new pay in the bottom of three intervals between 10,659-12,100 ft. in an extension test on the westerly edge of the field. It was completed flowing 33°-gravity crude at a 1,200 bbl. daily rate.

The Bridge pool first made news several years ago when a major discovery was made through the unique method of drilling through the Oakridge fault and into Pliocene formations which are overlain by older Miocene formations in the geologic puzzle of the region.

Actual perforations of the discovery interval are at 11,746-12,051 ft. Total depth of the well, 2 Hill, is 12,615 ft.

Sebastian discovery proves small

Initial production figures on Standard Oil Co. of California's wildcat in the Sebastian area of Kern County 1½ miles northeast of the North Tejon field failed to live up to earlier test results. Post completion production figures credit the 13,801 ft. TD well with only 5 bbl. daily and 23 bbl. daily of water. It is pumping from an interval at 7,852-7,967 ft. and 8,188-8,354 ft.

New discovery in LaHonda area

SAN MATEO County's small LaHonda field area was being credited with a possible new-field discovery with completion of a wildcat by Neaves Petroleum Developments Co. The Neaves well, 1 Union-Burns, is located 1½ miles southeast of the LaHonda field.

On production test, it pumped 11 bbl. daily of clean 19°-gravity crude from an interval at 1,425-50 ft.

This area sets some kind of a record for consecutive years of exploration as the first well was drilled nearby in 1867 and drilling continues to the present day, but always on a very modest basis.

Tracy sand found in Vernalis test

Porter Sesnon and Great Basins Petroleum Co. continued their record of discoveries in the Vernalis gas field in San Joaquin County. The newest find gave Vernalis its first Tracy sand production. The operators tapped the new zone just above the plug at 4,954 ft. On a production test, the 2-ft. Tracy zone flowed at a rate of 5,500 M.c.f.d.

Palo Duro well reentered for new pay

The discovery well for oil in the Texas portion of the Palo Duro basin has been reentered, a new pay opened up, and completed for 245 bbl. of oil daily plus 59% water. This old well discovery is Shell Oil Co.'s 1 Alamosa Ranch "B" 5 miles southeast of Alamosa Virgil field in Oldham County, Texas Panhandle. It is the discovery well of the East Alamosa Ranch granite wash field, completed in 1957 from perforations at 7,122-43 ft. Up to the first of this year the well had made 76,623 bbl. of oil. The new pay is in Pennsylvanian granite wash at 6,664-68 ft.

Panhandle well has Tonkawa pay

Tonkawa oil production was confirmed at a new discovery area in northern Lipscomb County, Texas Panhandle.

Texaco, Inc., 1 Anna Frass "B," the discovery well, was confirmed at 1 Anna Frass "D" in Section 18, Block 10, HT&B Survey, northwest offset. The well is still testing. Location is 17 miles north of the town of Lipscomb.

Workover produces new Panhandle flow

This shows what can be done in working over old wells. Pan-Petro, Inc. confirmed pay in its 1 Barrett, a recent discovery, with workover of another well ¾ miles southeast.

The 1 Helton, an old 8,825-ft. dry hole in south-central Ochiltree County, Texas Panhandle, was gone back into, cleaned out to old total depth, and casing set at 8,820 ft. Perforations in the Novi sand, producer in the discovery well of Pan-Petro Novi field, at 8,464-84 ft. got 3 M.M.c.f.d. with an oil spray.

The flow changed to oil after 10 hours. After acid and swabbing, the well kicked off to flow 60 bbl. of acid water and 365 bbl. of oil in 10 hours. This flow ranged from 30-50 bbl. per hour with about 2 M.M.c.f.d.

Location of this prolific workover discovery is 26 miles south of Perryton in Section 127, Block 13, T&NO Survey.

Ochiltree well gets new Morrow gas

A new gas pay, upper Morrow Pennsylvanian, is reported by Sinclair Oil & Gas Co. in Southeast Farnsworth field in Ochiltree County, 9 miles southeast of Farnsworth.

The 2 Buzzard, Section 75, Block 13, T&NO Survey, flowed 2,730 M.c.f.d., natural, through ⅛-in. choke from perforations at 8,280-85 ft. The sand is the Buckhaults of upper Morrow age. It produces oil at Farnsworth field to the northwest.

West Texas data book

Petroleum Review, Kent County, West Texas, by Phifer Petroleum Publications, P. O. Box 20,024, Houston 25, brings the county's oil data up to June 1, 1959.

Petroleum Review is the title of a series of data books on Texas' producing counties. Information includes a chronology of field discoveries, production records by fields, discovery wells plus status of fields as of June 1, 1959.

The book is well illustrated with maps, a geological chart for the area, electric logs and field contour maps. For a list of other counties reviewed, write the publisher.

Another Las Vegas test slated

IN NEVADA Tri-State Exploration Co. announced location for a wildcat in NE SW NE 22-21s-56e, in Clark County about 30 miles southwest of Las Vegas. No depth was announced or spud date set.

Also in Clark County, but some 30 miles east of Las Vegas, Shell Oil Co. was drilling ahead below 5,530 ft. on its 1 Bowl of Fire Unit. The rumor was circulating that Shell had run at least one test in the remote southern Nevada wildcat already.

In Paradox

Utah gets second '59 Penn strike

NEW Paradox Pennsylvanian production was established at a wildcat in San Juan County, Paradox basin, southeastern Utah. The discovery well, the second for the year in the basin, is Carter Oil Co. and British-American Oil Producing Co.'s 1 Government-Norwood in C NW NW 15-40s-22e.

The operators completed the well on pump for 100 bbl. of oil daily and 280 bbl. of water from the Bluff zone at 5,647-5,665 ft. Location is 1¾ miles northeast of Bluff Bench field.

Earlier this year, Triton opened a small Pennsylvanian pool to the north of the new Bluff area discovery.

THE YEAR'S second oil discovery in the Utah portion of the Paradox basin is Carter Oil Co. and British-American Oil Producing Co.'s 1 Government-Norwood.

Poison Springs . . . Reports have it that Tennessee Gas Transmission Co. staked the first of a series of strat tests in the Poison Springs area on the northwest side of the Paradox basin in Garfield County. It was here that a huge Pennsylvanian reef was discovered last year at a Garfield wildcat. Though the well was dry, it was considered one of the most important wildcat events of 1958.

. . . and Colorado has year's third success

THE YEAR'S first important discovery of the year in Colorado's portion of the Paradox basin is reported at Texaco, Inc., 2 Ute Mountain Tribal in NE SE 21-33½n-20w, Montezuma County.

This well swabbed 34 bbl. of oil per hour from Pennsylvanian perforations at 5,712-16 ft. This is the first apparent followup success to the Towaoc discovery which flowed 1,200 bbl. daily to become the first production in the Colorado portion of the basin. Other offsets to the discovery were failures. Production apparently is defined on the east, north, and west of the discovery well. There has been no drilling on the southwest side for 9 miles.

Other activity . . . Exploration is picking up throughout the Four Corners region after a definite lag. New Mississippian wildcats are slated for Wayne and San Juan counties in Utah. Sinclair will go to Mississippian at a wildcat 22 miles northwest of Mexican Hat. American Metal Climax Co. will drill a Mississippian test in Wayne County, southeast of South Last Chance field.

In Colorado, Pan American Petroleum Corp. plans a north offset to the Flodine Park field discovery in Montezuma County.

On the north side of the Paradox basin, Pure Oil Co. will drill another Cambrian test. The 1 Northwest Lisbon in NE NW 10-30s-24e, San Juan County, will go to about 10,000 ft. Location is 20 miles northwest of the 1 Government-Lisbon in San Miguel County, Colorado. That well is also planned for Cambrian.

Kansas action in two counties:

Meade County

The busiest exploratory arena in Kansas these days is Meade County which has had four important pool openers this year and several new-pay and extension strikes. Skelly Oil Co. reports two more strikes.

Skelly 1 Carl Evans in C SE SW 1-33s-29w, 9 miles southeast of Plains and 3 miles north of Northeast Mohler field, flowed 2,901 M.c.f.d. from Morrow sand at 5,604-45 ft. From the Chester Mississippian the well got 2,740 M.c.f.d. at 5,604-74 ft. This well is just 2¼ miles southwest of the big strike at Shamrock 1 Boyer, reported to be the second biggest gas well in the state.

About 3 miles west of McKinney field, Skelly has another strike, the 1 Ida Bohling in C SW SE 10-34s-27w. This is an indicated Mississippian gas hit.

Grant County

Council Grove Permian gas production is reported at a Grant County wildcat in southwestern Kansas. Hugoton Production Co. completed its 2 Nafziger in C SW NE 3-29s-37w, 1½ miles south of Ulysses and 13 miles northeast of Panoma Council Grove field.

The well flowed 2,184 M.c.f.d. from perforations at 2,683-2,780 ft. This was a Hugoton field deep wildcat test. Deeper zones in the Pennsylvanian were nonproductive. Tops include the Lansing at 3,934 ft., Missouri at 4,500 ft., Cherokee 4,675 ft., Atoka 4,954 ft., Morrow 5,296 ft., and the Mississippian 5,485 ft.

In the East . . .

Buckeye drilling goes deep

IN OHIO, action in deeper production possibilities has stepped up.

Ohio Fuel Gas Co., East Ohio Gas Co., and Wiser Oil Co. have started drilling another joint deep test in Medina County. This second test, 1 M. E. Warner, Lot 42, Granger Township, is about 4 miles southwest of their first test, 1A F. Smith, Lot 69, Hinckley Township, that was completed in February of this year. Again the scheduled target is the basement complex and will be drilled by rotary tools.

The location was based on seismic investigations in the area that indicated an interesting anomaly at this site. These investigations followed the gravity and magnetometer surveys conducted before the first test.

Also, in the southwestern corner of Monroe Township, Coshocton County, a recent Clinton (Medina formation) dry, 1 H. Johnson, Lot 32, is to be deepened about 2,500 ft. with cable tools to approximately 5,800 ft. to explore formations below this section. Participants in this venture are Natol Corp., W. E. Shrider, Oxford Oil Co., and Ohio Fuel Gas Co.

This is a rank wildcat and is more than 60 miles southwest of 1A F. Smith well, whose production experience to date has been very encouraging. The above well and locations are indicated on the state map.

Ohio gas areas grow in Licking . . .

In Ohio, Natol Corp. reports the completion of their 1 Mount Pleasant Church, in Section 11, Fallsbury Township, Licking County, an eastward extension to Fallsburg pool.

The Clinton was logged at 2,991-3,049 ft. and had a show of gas and oil natural. In a 24-hour test after fracture, well gaged 100 bbl. oil and an estimated 150 M.c.f.

and Ashtabula counties

In Ohio, Canton Oil & Gas Co. announced the completion of the first offset, more than 1 mile northwest of new pool discovery in Denmark Township, Ashtabula County.

Their 1 Emerson Fowlic, Section 17, logged the Clinton at 3,368-3,415 ft. and had a showing of oil and 82 M.c.f. natural and after fracture gaged 24 bbl. oil and 500 M.c.f.

Illinois bags successful trio

Three new oil pools, West Seminary in Clay County, Raymond South in Montgomery County, and Passport North in Richland County, were discovered in Illinois in June.

There were discoveries of six extensions to pools, as follows: three to Clay City Consolidated pool in Jasper, Richland, and Wayne counties, and one each to Mount Auburn Consolidated in Christian County, New Memphis North in Clinton County, and Whittington West in Franklin County.

A total of 178 wells were completed in June, an average of about 45 a week for the 4-week period. This is an increase of 10 wells a week from the 35-a-week average in May. The June completions include 96 oil wells, or a success ratio of about 54%. In addition four wells which had previously been completed as dry holes were worked over and recompleted as oil wells.

Two of the June completions were drilled to depths over 4,000 ft. Pure Oil Co.'s 18 C. T. Montgomery "B" well in 4-3n-9e, Richland County, was drilled to a total depth of 6,800 ft. in the St. Peter sandstone. It was plugged back to 3,140 ft. and completed as a producer in the St. Louis limestone.

National Associated Petroleum Co.'s 1 F. J. Kalberkamp in 19-1n-1e, Marion County, was completed as a dry hole at a total depth of 4,160 ft. in the Trenton limestone.

In addition H. H. Weinert worked over an old well, the 5 Morlan "B" in 33-2s in 33-2s-7e, Wayne county, and completed it as a producer in the Harrodsburg Limestone of Mississippian age. Total depth of the well is 4,148 ft.; top of the Harrodsburg Limestone is 4,132 ft.

Estimated production for Illinois for June is 6,374,000 bbl. of oil.

Hugoton's deep push continues to reward

The deep play inside Hugoton field in the Oklahoma Panhandle continues strong with a second oil pay reported at Northwest Hough field in Texas County. Republic Natural Gas Co. dually completed its 3 Welch in C NW SE 13-5n-13eCM.

Flow was 167 bbl. of oil per day on 30/64-in. choke from Morrow "A" sand at 6,166-86 ft. Earlier the well confirmed the field discovery with Morrow Pennsylvanian "G" sand production at 6,530-36 ft. This zone got 251 bbl. of oil daily.

McAlester gas action

Oklahoma's McAlester basin is back in the gas news with deep Atoka Pennsylvanian gas production reported in shallow Norris field, eastern Latimer County in the southeast part of the state.

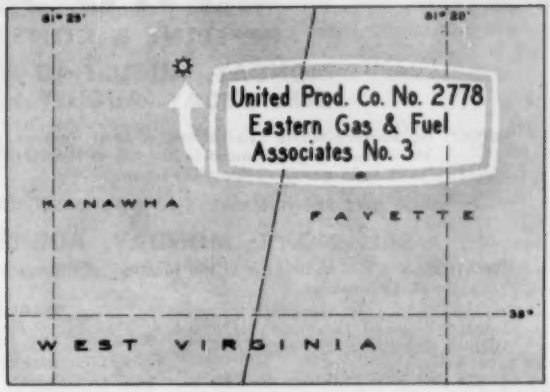
Midwest Oil Co.'s 1 Orr in C SW 8-6n-22e, flowed 6,700 M.c.f.d. at 7,210 ft. with the volume rising to 8,700 ft. per day at 7,222 ft. The well is being drilled partially tight. The operator is drilling with air.

West Virginia's

Cabin Creek adds No. 4

A BIG GAS WELL is reported in Cabin Creek district, Kanawha County, West Virginia. The discovery well is United Producing Co. 2778-Eastern Gas & Fuel Associates 3.

The Weir sand gasser made 18 M.M.c.f.d. through 5½-in. producing string. Rock pressure for 48 hours was 735 psi. This is the fourth completion on a 17,000-acre lease. The wells have a combined total open-flow of 23,052 M.c.f.d. All are shut in due to insufficient delivery facilities. Plans are to install pipeline system with delivery hoped for soon.



WEIR SAND gas production is reported at a shallow wildcat in Kanawha County, West Virginia.

Gladys field's reserves continue to mount

In Gladys field, Pocahontas County, West Virginia, Columbian Carbon Co. completed its GW-1297 U.S.A. I-3, Pocahontas 15 for 1,894 M.c.f.d. through 5½-in. production string after fracture. This well, total depth at 6,085 ft., is producing from chert and Oriskany sand. Location is on the Blackwater anticline in Greenbank district, Durbin Quadrangle, 5,500 ft. West longitude 79° 45′, 7,000 ft. North latitude 38° 40′, and 4,200 ft. northwest of the GW-1291 Pocahontas 11 well which made 17,250 M.c.f.d.

Susitna Flats wildcat resumes

IN ALASKA, Anchorage Gas & Oil Development Co., Inc., resumed drilling on the 6,105 ft. 3 Rosetta in the Susitna Flats area 32 miles north of Anchorage, Alaska.

In addition to the above activity, Anchorage Gas & Oil was building a road to a drill site for 4 Rosetta to be drilled about ½ mile northeast of 3 Rosetta.

EVER WONDER ??

GEOQUESTION . . .

Is it Sprayberry or Spraberry?

GEOANSWER . . .

Spraberry is correct. This is one of the most common spelling errors in the literature. It is a family name.

Here's New Mexico drilling in:

Roosevelt, Lea . . .

Two Pennsylvanian fields bordering both sides of the county line between Roosevelt and Lea counties, have been linked by a 600-bbl. well.

The new producer is Atlantic Refining Co. 1 Federal-Gulf, in SE SE 35-8s-36e. After washing perforations at 9,654-70 ft. with 500 gal. of mud-acid, the well flowed 140 bbl. of oil in 5½ hours through ½-in. tubing choke, which gave it a daily potential of 609.6 bbl., plus 50 bbl. of water.

No. 1 Federal-Gulf is approximately ½ mile from nearest production in the Allison and North Allison fields.

Eddy . . .

Texas Pacific Coal & Oil Co. 3-A-3 New Mexico-State, deep test in the old Jalmat area 15 miles northwest of Jal, reported free oil and gas while drill-stem testing the Abo section.

A 3-hour test at 7,790-7,820 ft. had gas at the surface in 40 minutes. Operators reversed out contents of drill pipe and recovered 100 ft. of 35° oil and 150 ft. of heavily oil and gas-cut mud. Flowing pressure reached 115 psi. on the test, and 3,020 psi. when shut in.

Tentative top on the Abo was 7,636 ft. The test is scheduled to 8,000 ft. It is an area of shallow Permian production.

The Abo pay . . . The Abo pay is a barrier reef of lower Leonard (Permian) age and extends across southeastern New Mexico in the subsurface from depths of 4,500-8,300 ft. (see The Oil and Gas Journal, June 22, 1959, p. 146). The pay is not new to Southeast New Mexico, but recently has come in for further study, along with a small boom in drilling. Empire Abo field in Eddy County is credited with large oil reserves at reasonable depths, in reef sections up to 600 ft. thick. Lovington field in Lea County also has Abo pay. Both fields are rated high in per acre yields.

Texas Pacific's well will bear watching as it may be the southernmost well to find Abo reef oil.

and San Miguel counties

A shallow cable-tool wildcat will be drilled at the New Mexico end of the long three-state Palo Duro basin. J. D. Carmichael will go to 1,000 ft. at a San Miguel County wildcat, 27 miles southwest of Las Vegas, New Mexico. The 2 Federal will be in 4-14n-12e, 2½ miles from an 1,825-ft. dry wildcat and more than 100 miles from any production.

TWO AUCTIONS

PIPELINE & CONSTRUCTION EQUIPMENT

MONDAY, AUGUST 10 PERRY (TALLAHASSEE), FLORIDA
WEDNESDAY, AUGUST 12 EUSTIS (ORLANDO), FLORIDA

NOTICE: Midwestern-Walco Contractors, a Joint Venture, is being dissolved and all equipment will be sold in these auctions. This equipment is just off of the Florida Natural Gas Pipeline job. It has been well maintained and most is in good working condition.

EACH PIECE POSITIVELY SELLS TO THE HIGHEST BIDDER WITHOUT LIMIT, MINIMUM OR RESERVATION ! ! !

SALE NO. 1: MONDAY, AUGUST 10, 9:00 A M — PERRY, FLORIDA

LOCATION: 1½ mi. Northwest of the junction of Hiways 19, 27 & 98, just off Hiway 27. Perry, Fla. is 50 miles Southeast of Tallahassee.

DRAGLINES—BACKHOES

Lorain L-26-30 Dragline, S/N 29434; 3 Bucyrus-Erie 22-B Draglines, S/Nos. 119705, 104341 & 90228; 3 Unit 1020-A Backhoes, S/Nos. 57074, 55452 & 53213; Buckets.

SIDEBOOM TRACTORS

Eight Cat D-8 Tractors, S/Nos. 2U-11450 to 1H-3594, all with Trackson Sidebooms; Four AC HD-19's with Berg Sidebooms; Cat D-7, S/N 3T-22501, with boom; 3 IHC TD-18's (2 are TD181's) with Sidebooms.

DOZER & WINCH TRACTORS

Five IHC TD-24's, S/Nos. TD241-8741 to TDE5261, with Angledozers, front PCU'S, some Towing Winches, AC HD-20 with Dozer & Towing Winch; 2 HD-19's with Carco Winches; Cat D-7, 17A with Dozer & CCU; 2 AC HD-16's with Dozers & Carco Winches; HD-15 with Dozer & Winch; Oliver OC-18 with Winch; 2 IHC TD-18's with Carco Winches.

TRENCHER—BENDER—LOADERS

Cleveland 320 Trencher, S/N K-153, Cat Power; CRC Vertical Bending Machine on Athey Tracks; Hough HF Payloader; 3 Ferguson TO-20 Hi-Lifts; IHC & Ferguson Wheel Tractors; Johnson-Lubin 8 Ton Batch Plant; Thoromix 11S Mixer.

WELDERS—PUMPS—MISC.

22 LINCOLN Diesel 300 amp Welders; 3 Lincoln Diesel 250 amp Welders; 20 Lincoln 200 amp Welders; 9 Lincoln Electric 300 & 200 amp Welders; 4 G.E. 200 amp Electric Welders; 9-6" Pumps, mostly Gorman-Rupp & Barnes; Smaller Pumps; H&M Beveling Machines; Cleveland Twin Wagon Drills; Athey Wagons; Large Quantities of other items.

TRUCKS—TRAILERS

8 IHC & Ford Winch Trucks, to 1958; '58 IHC A-160 Fuel Truck; '57 Ford F-600 Marmon-Herrington Truck; 1959 Chevrolet Truck Tractor; Leland Tandem Float; 2 Leland Pole Trailers; '55 & '56 Dodge Power Wagons; 2-1958 IHC 4-Wheel Drive Pickups; 4 IHC '57 Pickups; '58 IHC 4-Wheel Drive Travelall; 9 Chevrolet 1959 Pickups; 8 Chevrolet Pickups to 1958.

SALE NO. 2: WEDNESDAY, AUGUST 12, 9:00 A M — EUSTIS, FLORIDA

LOCATION: Lake County Fair Grounds on N. edge of town. Eustis is 30 mi. Northwest of Orlando or 50 mi. Southeast of Ocala, Fla. (NOTE: This sale site is about 180 miles Southeast of the Perry, Fla. sale site.)

DRAGLINES—BACKHOES—TRUCK CRANE—BACKFILLER

2 Bucyrus-Erie 22-E Draglines, S/Nos. 104344 & 90229, Cat Power; Backhoe Front for 22-B machine; Four Unit 1020-A Backhoes, S/Nos. 57157, 56103, 56106 & 55440, all with GMC power; Cleveland 190 Backfiller, S/N B-9204; Shield-Bantam ⅜ yard Truck Crane, S/N 2046; Buckets.

SIDEBOOM TRACTORS

7 IHC TD-24 Tractors, S/Nos. 4177 to 2047, all with Superior Sidebooms; Cat D-8, 2U with Sideboom; 2 AC HD-19's with Berg Sidebooms; 6 Cat D-7 Tractors, S/Nos. 3T-22705 to 7M-3312, all with Trackson Sidebooms; AC HD-15 with Sideboom; IHC TD-181 & TD-142 with Sidebooms.

DOZER & WINCH TRACTORS

3 IHC TD-24 Tractors, S/Nos. 6391 to 5262, with Dozers & Carco Winches; AC HD-21, S/N 7110, with Dozer & Carco Winch; HD-19 with Carco Winch; HD-16 with Hydraulic Angledozer; IHC TD-18 with Winch; Oliver OC-18 with Winch; John Deere L-440 with Dozer; Ferguson Tractor.

TRENCHERS—BENDING MACHINES

2 Cleveland Model 320 Trenching Machines, S/Nos. K-175 & K-109; 2 CRC Vertical Bending Machines, S/Nos. 30BB124 & 22, one New in Dec., '58.

WELDERS—PUMPS—MISC.

29 Lincoln Diesel 300 amp Welders; 2 Lincoln Diesel 250 amp Welders; 13 Lincoln 200 amp Welders; 4 Gorman-Rupp 6" Pumps; Other Pumps; Quantities of smaller & miscellaneous items.

TRAILERS—TRUCK TRACTORS

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Illinois counties show new activity

SUMMER DRILLING ACTIVITY is picking up momentum in the Illinois basin with White, Jasper, Saline, and Wabash counties all reporting new discoveries of importance.

In White County, 3 miles east of Enfield, Ill., Coy Oil Co. is completing a good well at 1 Virgil T. Murphy Comm., NE NW SW 13-5s-8e. This well swabbed 10 bbl. of oil per hour, natural, from Aux Vases Mississippian sand at 3,120-45 ft. Testing continues at what is thought to be the best Aux Vases well in the area.

In Jasper County, M. L. Van Fossan 1 Celia Schafer Unit, NE SW SW 26-6n-10e, made 211 bbl. of oil per day, natural, from McClosky Mississippian lime at 2,886-94 ft. The new pumper is 4 miles southeast of Newton.

In Saline County, E. E. Rue 1 George Oglesby, NW SW NW 27-8s-6e, 2 miles south of Raleigh, made 200 bbl. per day flowing through choke after fracturing the Waltersburg sand at 2,046-60 ft.

Rosiclare lime production opened a new pay zone in Wabash County at Delbert Runyon and Murvin Oil Co. 1 Margaret Keepes, SE SE NW 24-1s-14w. The well, 2 miles north of Bellmont, got its oil at 2,868-73 ft.

Montana's fields will be subject of study

Montana's oil and gas industry will be aided through a special study to be undertaken during the summer by personnel of the Montana Bureau of Mines and Geology, Butte.

Dr. Eugene S. Perry, who authored the Bureau's Memoir 35 on "Oil and Gas in Montana" which was published in 1953, will investigate each of the 30 new Montana oil fields discovered since that time. It is expected that his work will provide further information on Montana's geology.

There has been an exceptionally heavy demand for Memoir 35 which is now outdated because of the recent discoveries. Dr. Perry intends to have a new publication incorporating the results of his investigations ready within 1 year. He plans to visit the northern, central, and eastern oil fields during the months of June, July, and August.

Dr. Perry is professor of geology at the University of South Carolina, Columbia. From 1927-1952 he was head of the department of geology at Montana School of Mines and chief geologist for the Montana Bureau of Mines and Geology.

Sidney L. Groff, chief of the Bureau's ground-water and fuels branch, will accompany Dr. Perry, and assist him in gathering information on oil and gas occurrence in Montana.

Extension well on East Texas' Bethel dome

Texaco, Inc., has completed its 1 M. J. Derden in Bethel Field of western Anderson County, as a gas-condensate well extending production on the northeast flank of Bethel dome.

Potential at 1 Derden was 5.8 M.M.c.f.d. plus 123 bbl. of 54.4° condensate, from Rodessa perforations at 9,517-38 ft. The field is between Cayuga and Tennessee Colony.

New work at Bethel Dome . . . has been announced by Gragg Drilling Co., Palestine. The firm's 1 O. L. Gragg will be drilled to 10,500 ft., which is expected to penetrate the Rodessa. Location is on a 220-acre tract in the A. M. Lewis Survey, A-481, in Juan N. Acosta Grant. It is on the southeast flank of Bethel dome, about 3 miles southeast of Bethel townsite.

Gragg's test is slightly less than 1

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mile southwest of the field discovery, which flowed 4.6 M.M.c.f.d. and 173 bbl. of condensate from Rodessa pay at 9,793-9,839 ft. It is also 1 mile south of Texaco's 1 Derden.

Third zone completed at Texas' East Linden

Pan American Petroleum Corp. 1 Giraud Gas Unit, discovery of East Linden field in southern Cass County, has made potential test on a third zone in the Cotton Valley formation.

Completion gage on the third zone was 129 bbl. of 51.9° oil a day through 14/64-in. choke. Flowing casing pressure was 300 psi. Gas-oil ratio was 476:1. Perforations were at 9,864½-74½ and 9,951-58 ft.

In May of this year the well was completed from Cotton Valley perforations at 10,620-38 and 10,653-63 ft., flowing at the rate of 281 bbl. of 48.8° oil a day through 8/64-in. choke. Flowing pressure on tubing was 2,225 psi.

Second zone to be completed was also the Cotton Valley, at 10,254-62 and 10,278-83 ft., which flowed 45 bbl. of 43° oil a day through 24/64-in. choke, with gas-oil ratio of 916:1. Total depth was 12,079 ft., plugged back to 10,750 ft. The well has two strings of casing.

No. 1 Giraud Gas Unit is 4½ miles southeast of Linden, in George S. Young Survey. Pan American has two wells drilling in the area.

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Small pumper from reworked dry hole

REWORKING an abandoned wildcat in northern Marion County, East Texas, has resulted in a small Pettet oil discovery.

Whelan Brothers, Marshall, 1 Mary Torrans, 3½ miles southeast of Lassater, was cleaned out to 7,344 ft. Perforations at 7,210-19 and 7,228-39 ft. were treated with 10,500 gal. of acid. The well then made 32 bbl. of 39° oil a day on the pump, with no water reported.

The well is on a block of 12,000 acres in the Joseph Ward Survey, A-382. The well was originally drilled in 1956, to 7,619 ft. Cores in the Pettet at that time had oil shows.

Oklahoma's Cimarron makes oil news

OKLAHOMA Panhandle's Cimarron County made drilling news with the completion of Carter Oil Co.'s 1 Wells in C NW SE 10-1n-9eCM, Southeast Griggs field.

This well, located on the north side of the multipay Pennsylvanian oil and gas field, flowed open 25,150 M.c.f.d., calculated. Flow was from Cherokee at 4,308-64 ft. A Morrow sand at 4,624-31 ft. got 3,780 M.c.f.d. on tests. Open flow was 4,600 M.c.f.d.

Southeast Griggs is located in extreme southeast corner of the county.

Louisiana field confirmed by well

Discovery early this year of Parcperdue field, northeast of Abbeville, in Vermilion Parish, Coastal Louisiana, is confirmed by Texaco, Inc., in its second well, 1 Leonie Hebert, 1,600 ft. west of the initial well.

The confirmation well flowed 280 bbl. of 40.3°-gravity oil daily through 6/64-in. choke under pressure of 7,850 psi. Gas-oil ratio is 2,300 cu. ft. per barrel. Pay is perforated at 13,266-80 ft.

Discovery well, 1 Lill Bernard Sonnier Unit, is perforated at 13,278-88 ft. Its flow was gaged at 118 bbl. of 40.4°-gravity oil daily through 4/64-in. choke.

New gas-condensate pay for Louisiana

Southern Crude Oil Co. has a new gas-condensate discovery a mile off the south side of Theall field and 2 miles northeast of Southwest Esther field, in Vermilion Parish, Coastal Louisiana.

Its 1 Louis Mayard, in 7-14s-3e, flowed 2 M.M.c.f.d. through 8/64-in. choke from a 12,000-ft. pay, perforated at 12,160-64 ft. Gas yielded 28 bbl. of condensate. Flowing pressure was 4,000 psi. Total depth is 12,450 ft.

Theall field, discovered in 1956, has gas-condensate production from a 11,600-ft. sand. Southwest Esther, opened in 1958, is productive from 12,400-ft. and 12,900-ft. zones.

New oil field found in Lafourche

Discovery of another oil field in northern Lafourche Parish, Louisiana Gulf Coast, has been made by Sinclair Oil & Gas Co. It is about 7 miles southeast of Thibodaux, on the north bank of Bayou Lafourche, 1½ miles south of the Melodia area, and 3½ miles southwest of Lake Boeuf field.

Sinclair's new well, 1 Salvadore Segretto, in 38-15s-17e, is completed in a Miocene sand at 14,486-97 ft. after being drilled to 15,010 ft. It flowed 177 bbl. of 40.9°-gravity oil per day through 6/64-in. choke.

Prolific gasser drilled in Texas' Brazos

One of the best gas wells yet drilled in the revived development on the old Millican Dome, in Brazos County, Texas Gulf Coast, has been completed by Thomas W. Clay at his 2 Jerico. It is rated good for 64 M.M.c.f.d., open-flow, from the field's Queen City producing horizon at 2,746-49 ft. Hole was drilled to 3,463 ft. Test flows ranged from 789 M.c.f.d. through 12/64-in. choke with 1,127 psi. pressure, to 3,294 M.c.f.d. through 24/64-in. choke with 1,026 psi. pressure. Gas is dry.

Confirmation successful in Southeast Texas

Second effort by Oil Reserves Corp. to confirm its discovery last August of Clay Point field, in Newton County, southeastern Texas, has proved successful.

The confirmation well, 1 Kirby-Long et al. Unit, located 2,640 ft. west of the discovery well, is rated at 20,500 M.c.f.d. of gas with liquid

600-foot length of Thermoid-Quaker hose, self-propelled both off and on the reel, floated on inflatable rubber "sausages."

Quaker Thermoid floating ship-to-shore rig helps speed oil storage for new arctic air base

Increased air traffic over the polar route has called for an immense new airfield and oil-piping system at Frobisher Bay, Baffin Island, just completed by Foundation Company of Canada Limited.

Tankers pump petroleum products through a 600-foot Thermoid-Quaker Floater Hose assembly to a 15,000-foot pipeline feeding the huge tank farm at Frobisher. An 8" Thermoid-Quaker discharge hose is floated on special inflatable Thermoid-Quaker pontoons and reeled on a power winch. This three-part rig makes up the complete Thermoid-Quaker assembly.

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(60°-gravity condensate) recovery of 60 bbl. per 1 M.M.c.f.

Its pay zone, the same as in the discovery well, is perforated at 7,602-05 ft. The latter well, perforated at 7,640-42 ft., tested for open-flow potential of 16 M.M.c.f.d.

A test 1,400 ft. south of the discovery well, was dry at 7,762 ft. Confirmation well was drilled to 8,353 ft.

Second well confirms success in Texas Gulf Coast

Completion by Texaco, Inc., of its second well in Champion field, in Jasper County, confirms another recent southeastern Texas field discovery. It opens the second producing zone for this field.

Texaco opened the field last April at its 1 Champion, completed in Wilcox sand at 8,756-59 ft. with a flow of 6.7 bbl. of 44.5°-gravity oil per day through 12/64-in. choke. The second well, on a 6-hour test, flowed at the rate of 133 bbl. daily through 10/64-in. choke from a 300-ft. deeper Wilcox zone at 9,054-64 ft.

Gas-condensate hopeful ends up with oil pay

A Calhoun County, Texas, wildcat drilled in 1956 to 9,512 ft. by Layton Brown Drilling Co., and later, in August 1957, tested by another operator, W. G. Gill, as a gas-condensate well in sand at 8,457-65 ft., has ended up as an oil producer in a deeper pay at 9,103-09 ft. after a workover job by its third operator, Coloma Oil & Gas Co.

The well, now designated as 1 Mary A. Stofer, is in the North Coloma Creek area, 6 miles northeast of Seadrift. The 9,100-ft. sand tested 262 bbl. of 36.5°-gravity oil, plus 47% water, per day through 10/64-in. choke.

The well still is productive from the 8,450-ft. gas-condensate sand, and is being operated as a dual completion.

Rank wildcat set for Central New Mexico

Plans to drill a Pennsylvanian wildcat, or to around 4,000 ft., in southern Torrance County, New Mexico, have been announced by H. C. McAuley et al., Monahans, Tex.

Proposed test has been located in the SE NW Section 28, Township 3 North, 9 East, which is about 18 miles southeast of the town of Mountainair. Drilling will be with cable tools. The drill site is on a 40,000-acre block covering portions of Townships

2 and 3 North, Ranges 8, 9, and 10 East. Geologic location is on the northern tip of the Tularosa basin. Some maps show it as being in the Estangia basin.

Prolific gasser flows in Wyoming

A WILDCAT WELL, estimated to be capable of flowing at the rate of 18 M.M.c.f.d. of gas, was completed in Sublette County, southwestern Wyoming, by Carter Oil Co.

The test well, 15 miles south of Big Piney, Wyoming, is located on Carter's 8,320-acre Figure Four Canyon unit in the C SW NE SW 15-27n-112w. Geologically, it is located in the general La Barge platform area in the northewestern part of the Green River basin. It is also north and east of gas production in the East La Barge and Birch Creek unit areas.

Gas is from 51 ft. of net pay in the second Frontier formation and is through selected perforations from 7,626 to 7,784 ft. The open-flow potential of this well, one of the largest in the regional vicinity, points up the potential of the Green River basin as a gas-producing province.

Other companies besides Carter with an interest in the divided-type Figure Four Canyon unit are Belfer Natural Gas Co. and Pan American Petroleum Corp. Carter holds 48.8% interest in the unit, and has a 100% interest in the discovery well.

New pay zone found in Matagorda

Discovery of an additional producing zone for the new El Maton field in Matagorda County, Texas Gulf Coast, is announced by Lion Oil Co. Division of Monsanto Chemical Co. in the completion of its third development well.

This gives the field four separate sands already productive. All are between 9,800 and 10,700 ft. in the basal Frio section.

The new well, 1 Mehrens, is productive from the shallowest, in which it is perforated at 9,836-46 ft. Tested through ¼-in. choke, it flowed 4,505 M.c.f.d., recovering 148 bbl. of condensate. Calculated open-flow potential is 35 M.M.c.f.d. with 32 bbl. of condensate per 1 M.M.c.f.

The development is on a 2,800-acre block, in which Monsanto holds 35% interest with Superior Oil Co. and Sun Oil Co. as joint owners.

Discovery well was completed last January with gas-condensate produc-

This automatic Assistant eases the load on the driller

Now—drilling time can be reduced and the driller freed for other duties, with the new Model 6 Micromatic Drilling Control recently developed by the National Supply Company. It is available as original equipment, or can be installed in the field, on the drawworks of virtually all leading manufacturers.

This Drilling Control duplicates the precision handling expected from the most experienced driller, and gives this service automatically, constantly and untiringly. Only minor alterations are required to apply the Control to virtually any drawworks, regardless of size, and installation work can be done right in the field in approximately six hours.

Operation is easy and simple. The driller obtains the desired weight on the drill bit, snaps and locks the control connecting rod to the brake lever and then opens two air valves in the control cabinet—and the Micromatic takes over.

An accurate, responsive sensing device notes and immediately compensates for any change in the weight on the drill bit. Feeding is smooth and continuous, and the string is under full control at all times. Driller can increase or decrease weight at any point merely by manipulating an air valve, and the control can be disengaged, and manual operation restored, whenever desired.

Exhaustive field tests have proved out the utility and reliability of this important new contribution to drilling speed and efficiency, and have verified the ability of the Micromatic No. 6 to serve as "Driller's Assistant" in every operating condition normally encountered. If you would like more detailed mechanical or operational information, ask for Bulletin 507.

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tion from two sands, one at 10,036-43 ft. and the other at 10,120-30 ft.

Drilling now is under way on the field's fourth well.

Frio tapped in Galveston County

Pan American Petroleum Corp. is drilling a 15,000-ft. wildcat to find new deep Frio production north of Hitchcock field in Galveston County, Texas Gulf Coast.

It's 1 Stewart Title Guaranty Co. is inside the city limits of La Marque, Tex. At its projected total depth, the test will be the deepest within several miles of its location.

Permian opener in Hockley County

San Andres production has been extended in the Yellowhouse area of northwestern Hockley County, West Texas, at Big Spring Exploration, Inc. 1 Lawson, 10 miles northwest of Levelland.

On completion test the well pumped 185 bbl. of 32° oil a day from perforations at 4,711-27, and 4,738-44 ft. after treating with 4,000 gal. of acid. Gas-oil ratio was 250:1.

No. 1 Lawson is about 1 mile southwest of South Yellowhouse area, in SE SE of Labor 31, League 74, Haskell CSL Survey.

Second Queen well for Texas' Atapco field

Shallow exploration in the Atapco (Devonian) field of southwestern Crane County has given the area two wells in the Queen sand.

Southland Royalty Co.'s second Queen producer, a south offset to the field discovery in that pay, has been completed for a flowing potential of 222 bbl. of oil a day, plus 25% water. Flow was through 20/64-in. choke from perforations at 2,150-58 and 2,124-33 ft. Gravity of the oil was 38°. Gas-oil ratio was 422:1. Location is in Section 30, Block 1, H&TC Survey.

Discovery wells

ARKANSAS

Lafayette County: R. E. Williams Drilling Co. 1 Jones, SE SE NE 10-16s-24w. IP 70 BOPD, 10/64-in., 38°, TP 200 psi., GOR 300 cu. ft. per bbl., perf. 3,286-88½ ft., Paluxy. TD 3,834 ft. Extends Old Town field ⅝ mile southeast.

Coulston Drilling Co. 2 Cornelius Estate, 31-16s-23w. IP 264 BOPD, ¼-in., 40°, TP 325 psi., perf. 8,218-29 ft., Cotton Valley-Ford zone. TD 8,234 ft. Elev. 249 ft., Lower Cretaceous 3,020 ft., Cotton Valley 6,165 ft., Ford zone 8,216 ft. Discovery well East Kress City field.

Miller County: G. B. Christmas 1 Keller, NE NW NW 14-16s-27w. IPP 120 BOPD, 40°, perf. 3,356-62 ft., Paluxy-Young sand. TD 3,385 ft. Elev. 341 ft., Lower Cretaceous 3,123 ft.

Pope County: Bert Wheeler 1 Johnson, NW NW SE 24-9n-20w, 2 miles northeast of Dover. IP 6,500 M.c.f.d., calculated open flow, BH shut-in pressure 1,510 psi., perf. 3,380-3,403 ft., Atoka-Allen sand, and 7,125 M.c.f.d., BH shut-in pressure 1,720 ft., perf. 3,830-53 ft., Atoka-Barton sand. TD 4,894 ft. Discovery well Dover field.

WESTERN CANADA

Alberta: Pan American C-2 Lobstick Pembina, 14-3-50-7, LSD 14, 3-50-7w5. Cardium oil discovery. TD 4,540 ft.

Pan American A-1 2-23-54-26 Villeneuve, LSD 2, 23-54-26w4. Basal Quartz gas discovery. TD 5,440 ft.

CALIFORNIA

Kern County: Standard Oil Co. of California, 338-9 Universal Consolidated S.P., SE SW 9-11n-19w, 44 BOPD, 35.4° gravity, 50% cut, perfs. 7,852-7,967 ft. and 8,188-8,354 ft., TD 13,801 ft. (New field discovery 1½ miles northeast of North Tejon field.)

Contra Costa County: McCulloch Oil Exploration Co. of California, Inc., 1 McCulloch-Macson-Ginochio, NE NW 18-2n-1w, 1,500 M.c.f.d., perfs. 1,665-1,708 ft., TD 3,012 ft. (Re-completed as Nortonville sand discovery in Los Medanos gas field.)

Ventura County: Union Oil Co. of California, 2 Hill, NW NE 22-3n-21w, 1,140 BOPD, 32.2° gravity, 6.6% cut, 37/64-in. choke, perfs. 8,930-9,403 ft., 9,496-10,552 ft. and 11,746-12,051 ft., TD 12,615 ft. (Deeper pool discovery on west edge of Bridge Pool area, South Mountain field.)

NORTH LOUISIANA

Concordia Parish: R. A. Campbell 1 Dale, 36-7n-7e. IP 55 BOPD, 12/64-in., 36.5°, TP 100 psi., perf. 5,245-46½ ft., Wilcox. TD 6,002 ft. Elev. 65 ft., Wilcox 3,790 ft., base Baker shale 5,508 ft. Discovery well North Horseshoe Lake field—1 mile north Horseshoe Lake field.

SOUTH LOUISIANA

Cameron Parish: Magnolia Petroleum Co. 1 Miami Corp., 8-14s-7w. IP 284 BOPD, 6,500 M.c.f.d., 12/64-in., 47°, TP 5,841 psi., perf. 10,420-23 ft. TD 12,788 ft. New field—2 miles northwest of West Chenier Perdue field.

Jefferson Davis Parish: Continental Oil Co. 1 J. A. Bel et al., 34-7s-7w. IP 200 BOPD, 8/64-in., 40.7°, TU 1,125 psi., GOR 488 cu. ft. per bbl., perf. 7,086-90 ft. TD 8,836 ft. Extension and new pay in Thompson Bluff field.

Vermilion Parish: Texaco, Inc., 1 Leonie Hebert, 34-11s-4e. IP 280 BOPD, 647 M.c.f.d., 6/64-in., 40.3°, TP 7,800 psi., GOR 2,300 cu. ft. per bbl., perf. 12,-266-80 ft. TD 13,500 ft. Second well and new pay in Parc Perdue field.

MICHIGAN

Jackson County: Aurora and McClure 1 Bartell, SE SE SE 7-4s-3w, 1½ miles north of Pulaski pool. IP 162 BOPD, 12/64-in. choke, Trenton 3,765 ft., Black River 4,107 ft., gas 3,845-4,050 ft., oil pay 4,129 ft. TD 4,206 ft. Pulaski oil-pool extension.

St. Clair County: Glen A. Mills 1 Guldenstein, NE SW SW 31-4n-16e, 2 miles northeast of Ira oil-gas pool. IPP 12 BOPD, after fracture, Salina A-2 2,127 ft., Salina A-1 2,374 ft. Brown Niagara 2,517 ft. TD 2,641 ft. Pay 2,377-95 and 2,485-94 ft. New oil pool.

NEBRASKA

Banner County: Miami Petroleum Corp. 1 Young, C NW SE 24-19n-54w. IPP 71 BOPD and 20% water, "D" sand discovery, new field. TD 4,937½ ft.

Kimball County: Edward Mike Davis 1 Painter, C SW SE 13-15n-57w. IPP 300 BOPD, "J" sand discovery, new field. TD 6,713 ft. "J" sand.

NEW MEXICO

Chaves County: Ernest A. Hanson, M. A. Waters, and N. R. Williamson 1-A Pan American, 22-1s-27e. IPP 43 BOPD, 39.7°, Penrose sand 898-948 ft. TD 955 ft.

Eddy County: General American Oil Co. of Texas 5 Nunlee, 35-16s-29e. IP 160 BOPD, 20/64-in. choke, 37°, pay 2,614 ft. TD 2,636 ft.

W. C. Welch 1 Featherstone-Welch, 22-19s-28e. IP swabbed 50 BOPD, 36°, perfs. 1,773-85 ft. Old TD 2,628 ft., PB 1,800 ft. Recompletion.

Gulf Oil Co. 1-AC Eddy-State, 36-18s-25e, 9 miles southwest of Artesia. Recompletion, old TD 5,750 ft. IP 1,100 M.c.f.d., 1-in. choke, Pennsylvanian 8,998-9,110 ft. New TD 9,283 ft., PB 9,218 ft., elevation 3,514 ft.

Pan American Petroleum Corp. 1 A. L. Werthiem, 34-19s-25e, 10 miles southwest of Artesia. IP 357 M.c.f. in 14 hours, 14/64-in. choke, TP 300 psi., Pennsylvanian 9,442-58 ft. Recompletion. Old TD 10,486 ft., drilled as 1 Lakewood Unit.

Lea County: J. C. Barnes Oil Co. 1 Humble-State, 27-12s-34e, 10 miles west of Tatum. IP 253 BO in 21½ hours, 20/64-in. choke, 39.7°, Pennsylvanian 10,290-10,358 ft. TD 10,388 ft.

NORTHWEST NEW MEXICO

Rio Arriba County: Magnolia Petroleum Co. 1 Evans-Federal, NE SW SW 18-23n-1w. IPF 1,080 M.c.f.d. Pictured Cliffs discovery, new field. TD 3,974 ft.

LaPlata Gathering System 1-26 San Juan Unit 32-5. IPF 1,410 M.c.f.d., Mesaverde discovery, new pool. TD 5,801 ft.

NORTH DAKOTA

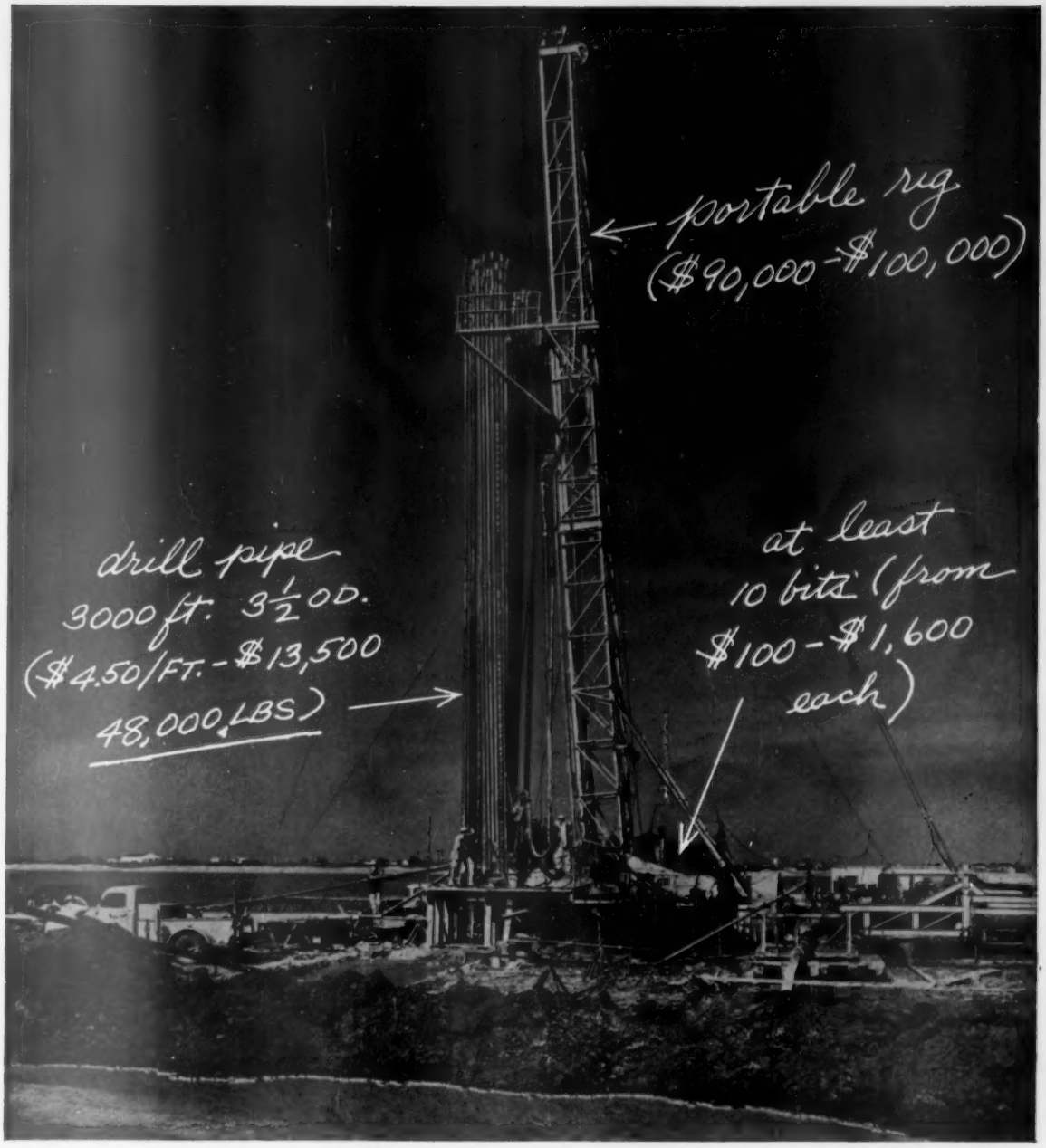
Billings County: Amerada Petroleum Corp. 1 R. Logan, NW SE 7-139n-100w. IPF 176 BO in 18 hours, 20/64-in. choke. Heath discovery, new field. TD 8,310 ft. Heath.

Burke County: H. L. Hunt 1 Anne Stavem, NW NE 31-161n-94w. IPP 80 BP, 212 BWPD, Midale discovery, new field. TD 8,027 ft. Nesson.

EAST TEXAS

Rusk County: F. R. Jackson, Maxwell D. Simmons 1 Lone Star Production Co., Henry Wells Sur., 4 miles southeast of Kilgore. Dual gas discovery, Danville field. IP 37,000 M.c.f. of gas, plus 9½ bbl. condensate per 1 M.M.c.f., Lower Pettet 7,383-92 ft.; IP 1,230 M.c.f. of gas, plus 36 bbl. condensate per 1 M.M.c.f., Travis Peak 7,606-14 ft. TD 7,721 ft.

F. R. Jackson et al. 1 Charles Y. Cochran, John Piburn Sur., A-28, 4 miles south of Henderson. Discovery of West Henderson field. IP 3,200 M.c.f. of gas,



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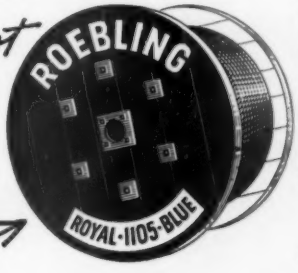

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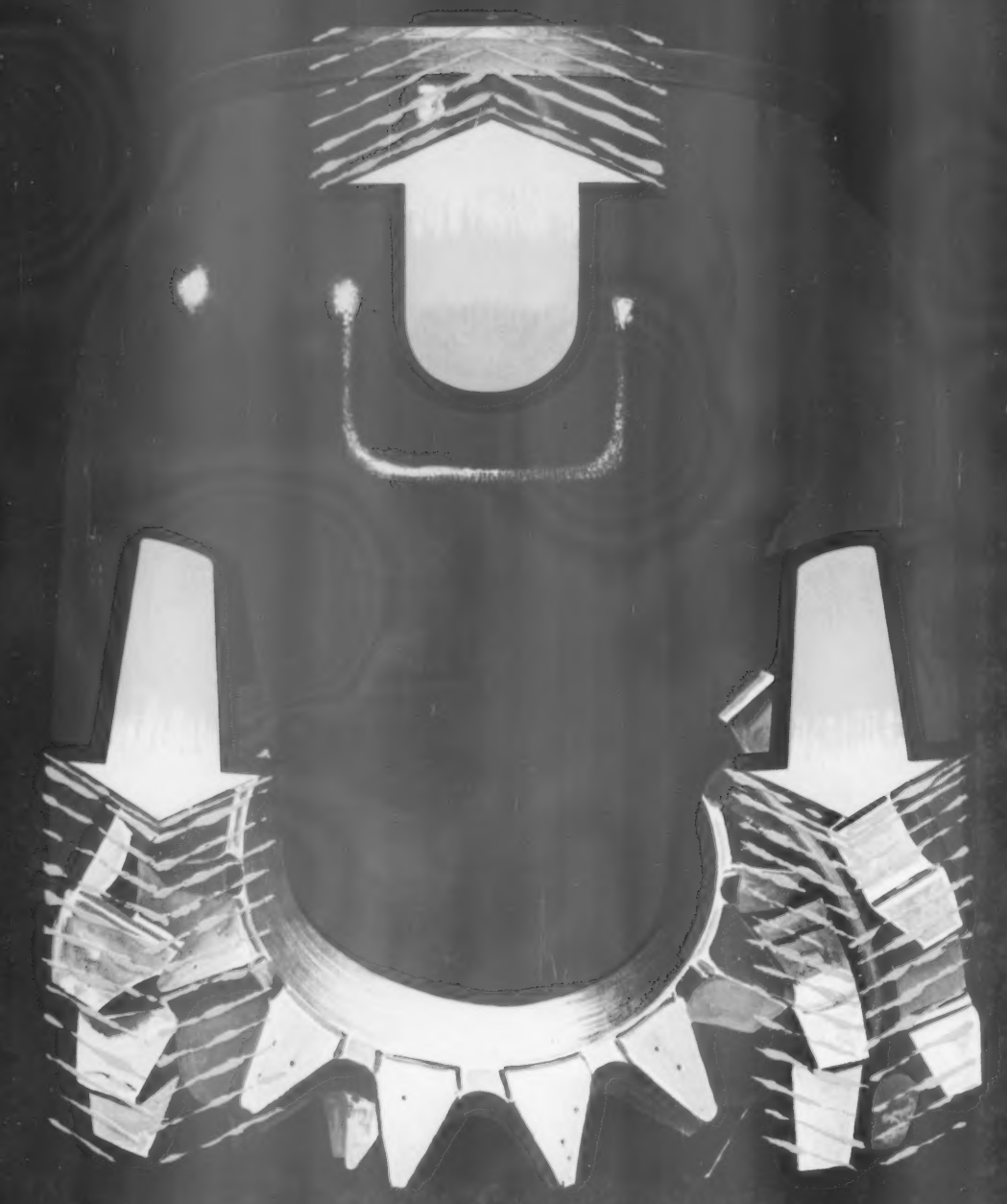

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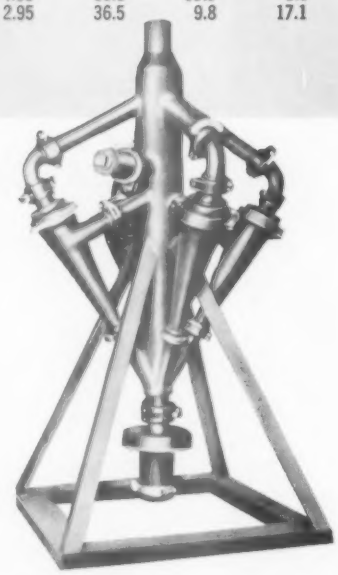
FIELD PERFORMANCE PROVES 85-90% BARITE RECOVERY

	Stream	Weight Lbs./Gal.	Flow, GPM	Per Cent Solids by Weight	Sp. Gr. Solids	Per Cent Barite by Weight	Barite Lbs./Min.	Clay Lbs./Min.	Barite Recovery Per Cent	Clay Rejection Per Cent
Chambers County, Texas ... 17.2 #/Gal. mud 3 Clones.. S.G. Bar = 4.26 (2/6/58)	U.F.	18.4	7.9	69.9	3.90	85.6	86.9	14.6	87.3	67.6
	O.F.	8.75	60.0	8.2	2.94	29.7	12.8	30.5		
Chambers County, Texas ... 17.2 #/Gal. mud 3 Clones.. S.G. Bar = 4.26 (2/6/58)	U.F.	17.25	8.1	69.4	3.87	84.4	81.9	15.1	90.7	69.0
	O.F.	8.75	61.5	7.8	2.82	20.0	8.4	33.6		
Vermilion Parish, La. ..... 18.1 #/Gal. mud 1 Clone ... S.G. Bar = 4.11 (3/5/58)	U.F.	20.0	3.0	78.0	4.06	98.0	45.8	1.0	85.5	89.8
	O.F.	8.8	19.1	9.87	3.14	47.0	7.75	8.75		
Cameron Parish, La. ..... 13.3 #/Gal. mud 4 Clones.. S.G. Bar = 4.20 (3/13/57)	U.F.	18.8	10.7	72.0	3.78	83.8	121.1	22.4	82.7	69.5
	O.F.	9.0	71.4	11.9	2.89	33.4	25.5	51.0		
Matagorda County, Texas ... 15.0 #/Gal. mud 4 Clones.. S.G. Bar = 4.20 (3/15/57)	U.F.	19.4	8.3	72.4	3.91	89.5	104.2	12.3	86.5	65.2
	O.F.	8.7	66.7	6.7	3.00	41.1	15.9	23.0		
Terrebonne Parish, La. ..... 14.0 #/Gal. mud 2 Clones .. S.G. Bar = 4.23 (7/6/56)	U.F.	18.8	6.3	74.4	4.05	93.8	82.5	5.5	84.4	76.0
	O.F.	8.9	32.0	11.5	3.09	47.2	15.4	17.4		
Calcasieu Parish, La. ..... 17.1 #/Gal. mud 1 Clone... S.G. Bar = 4.26 (5/17/56)	U.F.	19.6	3.8	74.8	4.18	96.8	53.8	1.9	84.5	90.0
	O.F.	9.1	20.0	14.8	2.95	36.5	9.8	17.1		

U.F. = Underflow; Barite Slurry Returned to Mud.
O.F. = Overflow; Clays and Water Rejected to Wash.

CLAYJECTOR

cuts mud costs, speeds drilling



Based on actual performance records, as shown above, the ClayJector is the simplest, most efficient device yet offered for separating troublesome clays and recovering valuable barites from the drilling mud. Operation pays off not only in savings of weighting material, but also in optimum mud control and consequently faster drilling and longer bit life.

The ClayJector is mechanically simple, easy to control and operate, and is so compact that it can be easily moved from hole to hole. Separation of the clays and barites in the DorrClones is by centrifugal action, requiring no moving parts. Maintenance is therefore negligible.

For more information, contact our U.S. Sales Representative, Salt Water Control, Inc., 1211 Fort Worth National Bank Building, Fort Worth 2, Texas.

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plus 16 bbl. condensate per 1 M.M.c.f., Travis Peak 7,512-24 ft. TD 7,691 ft.

Shelby County: Carter-Jones Drilling Co. 1 Pickering-Smith, Archibald Smith Sur., A-641, 13 miles southeast of Shelbyville, 1 mile south of Pettet production in Huxley field. IP 26,000 M.c.f. of gas, plus estimated 17 bbl. of 61° condensate per 1 M.M.c.f., Pettet 6,563-69 ft. shut-in TP 2,190 psi. TD 6,617 ft., elevation 195 ft.

TEXAS GULF COAST

Galveston County: John W. Mecom 1 John A. Roos, Trustee, Josiah Wood Sur., A-212, 4 miles south of Alta Loma. IP 166.08 BOPD, 3/16-in., 43.4°, GOR 1,772 cu. ft. per bbl., TP 1,400 psi., perf. 9,289-9,300 ft., Frio. TD 10,600 ft. New field.

Jefferson County: Humble Oil & Refining No. 6 Grace McMunn Fitzgerald, C. Williams League, A-59, 2 miles southeast of Amelia. AOF 10,800 M.c.f.d., GLR 21.46 M.c.f. per bbl., 56.1°, shut-in TD 2,674 psi., perf. 7,828-31 ft. and 7,843-52 ft., Lower Hackberry. TD 8,431 ft. New pay in Amelia field.

Kenedy County: Union Producing Co. 2 State Tract 348, Laguna Madre, surface location in Block 349. AOF 15,500 M.c.f.d., dry gas, shut-in TP 3,094 psi., perf. 7,859-61 ft., Frio. TD 9,061 ft. New pay in Mesquite Rincon field.

Kleberg County: Humble Oil & Refining Co. 154 King Ranch Borregos, Santa Gertrudis Grant, 8½ miles southwest of Kingsville. IP 66 BOPD (net), 80% water, 3/8-in., 32.9°, TP 380 psi., GOR 2,431 cu. ft. per bbl., perf. 7,452-56 ft., Vicksburg, and 172 BOPD (net), 13% water, 5/32-in., 1,550 psi., GOR 2,019 cu. ft. per bbl., perf. 7,344-47 ft., Vicksburg. TD 7,500 ft. New pays in Borregos field.

Nueces County: Carrl Oil Co. et al. 1 Lawrence & Heath, Section 20, Roberts & White Subd., Hoffman Petronilla Ranch, 3 miles northeast of Driscoll. IP 85.12 BOPD, X-37 choke, 22.3°, TP 225 psi., GOR 1,230 cu. ft. per bbl., perf. 5,334-40 ft. TD 5,975 ft. New pay in Petronilla Creek field.

Refugio County: Turnbull & Zoch et al. 1 F. B. Rooke, Block 26, La Rosa Ranch Subd. "C" Jose Miguel & Maria Alderette Sur., 9 miles southwest of Woodsboro, AOF 50 M.M.c.f.d., GLR 38.36 cu. ft. per bbl., 63.3°. Shut-in TP 2,493 psi., perf. 7,028-30 ft., 7,035-38 ft., and 7,042-49 ft., Frio. TD 7,515 ft. New field.

San Patricio County: R. L. Kirkwood, Burson & Luker 2 Richie, Section 44, Block 3, Fourth Addition Taft Farm Lands, 11 miles northeast of Taft. IP 2,500 M.c.f.d., ¾-in., TP 1,500 psi., perf. 5,170-67 ft., Frio. TD 7,097 ft. New field.

J. B. Moore and J. H. Helland et al. 1 McRae, D. Murphy Sur., A-367, 3 miles north of Mathis. AOF 3,800 M.c.f.d., GLR 66.7 M.c.f.d. per bbl., 49.3°, shut-in TP 2,010 psi., perf. 4,727-ft., Stillwell zone. TD 4,735 ft. New field discovery.

Engeo Oil & Gas Co. 1-B J. W. Mayo, J. Feenden Sur., A-119, 6 miles northeast of Taft. IP 143.52 BOPD, P-33 choke, 44°, TP 1,000 psi., GOR 629 cu. ft. per bbl., perf. 6,387-91 ft., and 176.64 BOPD, P-35 choke, 45°, TP 290 psi., GOR 594 cu. ft. per bbl., perf. 6,214-17 ft. TD 7,018 ft. New pays in Taft field.

Wharton County: Texkan Oil Co. 1 J. W. Michna, J. La Bauve Sur. 18, A-691, 9 miles southeast of Ganado. AOF 48 M.M.c.f.d., GLR 140 M.c.f. per bbl., 52°, shut-in TP 2,341 psi., perf. 6,249-53 ft., Frio. TD 7,267 ft. New field—1½ miles southwest of Louise field.

TEXAS GULF COAST

Bee County: Dougherty Group et al. 1 Byars & Golding, Jose Maria Uranga Grant, A-68, 8 miles northwest of Beeville. AOF 8,400 M.c.f.d., GLR 18.9 M.c.f. per bbl., 52.8°, shut-in TP 5,054 psi., perf. 9,935-63 ft., Wilcox—third Massive sand. TD 10,015 ft. New field discovery.

A. A. "Bus" Moore 1 Frieda Bremer, D. Dougherty Sur., A-156, 7 miles northwest of Tynan. AOF 256 M.c.f.d., dry gas, shut-in TP 878 psi., perf. 3,020-26 ft., Frio. TD 3-810 ft. New pay in Southwest Sliva field.

Chambers County: Standard Oil Co. of Texas 43 State Tract 94, Galveston Bay, 5 miles east of LaPorte. IP 191 BOPD, 13/64-in., 37.7°, TP 525 psi., GOR 1,-170 cu. ft. per bbl., perf. 7,477-83 ft., Vicksburg. TD 10,786 ft. New pay in Cedar Point field.

Colorado County: Cerro de Pasco Corp. 1 Wolf, Wolf & Becker Sur. 30, 5 miles northeast of Eagle Lake. AOF 2,350 M.c.f.d., 20 BC per M.M.c.f., 52.1°, perf. 9,018-20 ft., Wilcox. TD 9,212 ft. New reservoir ½ mile northeast Chumner field.

Galveston County: Sparta Oil Co. et al. 1 Hervey, Stephen F. Austin Sur., A-3, 2 miles southwest of League City. AOF 42 M.M.c.f.d., 40 BC per M.M.c.f., 55.8°, shut-in TP 3,499 psi., perf. 9,755-69 ft., Lower Frio TD 10,015 ft. New reservoir 1 mile west of North League City field.

Continental Oil Co. 1 State Tract 198, Galveston Bay, 9 miles northeast of San Leon (surface location in Branch Survey, Chambers County). AOF 10,-500 M.c.f.d., GLR 10.8 M.c.f. per bbl., 48.8°, shut-in TP 6,115 psi., perf. 13,202-18 ft., Frio, and 1,400 M.c.f.d., 250 BC per M.M.c.f., 9/64-in., TP 3,-600 psi., perf. 12,941-65 ft., Frio. TD 13,583 ft. New pays in East Smith Point field.

Goliad County: Sun Oil Co. and George H. Coates 1 Sophie Heller, Henry C. Kitchel Sur., A-174, 17 miles northeast of Goliad. AOF 2,600 M.c.f.d., dry gas, shut-in TP 619 psi., perf. 1,536-38 ft., Miocene. TD 4,150 ft. New pay in Schroeder field.

Fitzpatrick Drilling Co. 1 Paul Bethke, George W. Wright Sur., A-301, 8 miles northwest of Goliad. IP 7,500 M.c.f.d., GLR 143 M.c.f. per bbl., 52°, shut-in TP 1,856 psi., perf. 4,751-61 ft. TD 5,411 ft. New reservoir in Karen Beauchamp area.

Hardin County: Jack R. Love and Ada Oil Co. 1 Bryant Seay, D. Nichols Sur., A-606, 2 miles southeast of Village Mills. IP 3 M.M.c.f.d., 226 BC per M.M.c.f., 10/64-in., TP 1,900 psi., perf. 9,574-83 ft., and 6 M.M.c.f.d., 150 BC per M.M.c.f., 10/64-in., 2,540 psi., perf. 9,432-51 ft. TD 10,014 ft. New field.

Jackson County: Texkan Oil Co. 1 R. C. Burns Unit 1, W. D. Sutherland Sur., A-76, 3 miles east of Ganado. AOF 225 M.M.c.f.d., GLR 138 M.c.f. per bbl., 56°, shut-in TP 2,280 psi., perf. 5,936-40 ft., Frio. TD 6,600 ft. New pay in East Mustang Creek field.

TEXAS PANHANDLE

Roberts County: Pan American Petroleum Corp. 5 Lips Ranch "B," Sec. 167, Blk. C, G&M Sur., 15 miles southeast of Spearman in northwestern corner of county, 1¼ miles northeast of 8,470-ft. gas production in Lips Atoka field, 2 miles northwest of oil in Lips Cleveland field. IPCAOF 880 M.c.f.d., Cleveland sand 6,740-56 ft. TD 8,780 ft.

LOUISIANA

Plaquemines Parish: John W. Mecom 6 State 2028, Township 19s-26e. IP 189 BOPD, 3,124 M.c.f.d., 8/64-in., 44°, TP 5,900 psi., perf. 14,500-20 ft., and 300 BOPD, 8/64-in., 34.2°, GOR 1,990 cu. ft. per bbl., TP 4,700 psi., perf. 14,080-90 ft. TD 15,171 ft. New pays in Lake Washington field.

WEST CENTRAL TEXAS

Andrews County: Phillips Petroleum Co. 1-KK University, Sec. 22, Blk. 11, USL Sur., 22 miles southwest of Andrews. IP 45 BOPD, 18/64-in. choke, 40°, GOR 10,311:1, TP 380 psi., Wichita Albany 6,962-7,375 ft. Old TD 10,051 ft., PB 7,825 ft. Recompletion.

Crane County: Spartan Drilling Co. 1 Edwards, Sec. 22, Blk. 43, T4S-T&P Sur., 16 miles north of Crane. IPP 105 BOPD, 30°, Queen 4,066-82 ft. TD 4,465 ft. Elevation 2,117 ft.

Hockley County: Humble Oil & Refining Co. 1 Pentecost, Labor 19, League 19, Wichita CSL Sur., 13 miles southeast of Levelland. IPP 197.6 BOPD, 29.4°, GOR 232:1, Wolfcamp 8,602-36 ft. TD 10,791 ft. Elevation 3,445 ft.

Jones County: Daya Operating Co. 1 Phillips estate, Harrison CSL Sur. 334, Subd. 43, 8 miles west of Anson. IP 102 BOPD, 17/64-in. choke, 40°, GOR 475:1, TP 80 psi., Swastika 3,211 ft. TD 3,220 ft., elevation 1,846 ft.

E. E. Shaheen, Jr. 1 Ann Shaheen, Sec. 50, Blk. 15, T&P Sur., 7 miles northeast of Hawley. IPP 75 BOPD, 38°, pay 2,064-65, 2,073-76 ft. TD 2,170 ft., elevation 1,657 ft.

S. B. Roberts 1-B Moore, Sec. 21, Blk. 14, T&P Sur., 3½ miles southeast of Nugent. IPP 59 BOPD, 37°, GOR 70:1, Bluff Creek 1,718-22 ft. TD 1,915 ft.

Nolan County: Peel-Hardeman Oil Operator's 1 R. D. Nabers, Sec. 28, Blk. 1-A, H&TC Sur., 2 miles north of Blackwell. IP 164 BOPD, 20/64-in. choke, 50°, GOR 635:1, TP 320 psi., Ellenburger 6,290-95 ft. TD 6,324 ft., elevation 2,145 ft.

Sojourner Drilling Corp. 1 Dill Pace, Sec. 68, Blk. 20, T&P Sur., 10 miles southeast of Sweetwater. IPP 55 BOPD, 40°, GOR 500:1, Ellenburger 6,280-96 ft. TD 6,532 ft.

Palo Pinto County: Skelly Oil Co. 1-A Rhodes, Sec. 14, Blk. 1, T&P Sur., 3 miles northeast of Palo Pinto. IP 3,000 M.c.f. of gas, open flow, 55 BOPD, 64.4°, GOR 59,800:1, Marble Falls 4,244-48 ft. TD 4,371 ft. elevation 1,114 ft.

WEST TEXAS

Reeves County: Jack S. Reaves 1-A Regan, Sec. 26, Blk. 58, T2, T&P Sur., 9 miles west of Orla, 1 mile east of Screwbean field. IPP 98 BOPD, 28°, GOR 360:1, Delaware pay 1,005 ft. TD 1,012 ft.

Schleicher County: Chambers, Kennedy & Liedtke, Ltd. 1 Womack, Sec. 34, Blk. I, GH&SA Sur., 16 miles northeast of Eldorado. IPP 83 BOPD, 39°, GOR 864:1, Pennsylvanian 4,512-22 ft. TD 4,700 ft. Recompletion.

UTAH

Uintah County: Hyland Oil Co. 1 Bend Unit, N½ NE 8-7s-22e. IPF 3,870 M.c.f.d., Uinta discovery, new field. TD 2,950 ft. Uinta.

WYOMING

Sublette County: General Petroleum Corp. 24-30, NE NW 30-27n-113w. IPF 15,250 M.c.f.d., Frontier discovery, new pay. TD 8,115 ft. Second Frontier.

Stanley D. Breitweiser
". . . a good future in marketing."

Breitweiser Is an Old Hand

. . . in oil game—and still in his mid-40's. Sunray marketing boss started young, has been going strong ever since.

OIL MEN meeting Stanley D. Breitweiser for the first time are amazed that the strapping, youngish marketing executive really is a veteran of more than a quarter century in the oil business.

By his own admission, the new executive vice president and director of DX Sunray Oil Co., Tulsa, got into the oil business when he was a boy.

By the time he was 40, he had 21 years experience in the business—a record held by few men these days. Still in his mid-40's, Breitweiser retains a young man's enthusiasm for his job and a respect for the oil industry equalled by few others.

"Too few people in the oil game realize how good the industry has been to all of us," Breitweiser says. "I always am thankful I've stayed in the oil business."

"This was brought home to me a few years ago when I attended a seminar at Harvard. Those of us attending represented several industries. Naturally, we aired our problems. I came back convinced I'd rather have the oil industry's problems than some of the headaches executives in other industries face."

Maybe Breitweiser's respect for his industry stems from stern lessons learned in the depression when he first went to work. Perhaps it reflects his own success, but at least his attitude explains why he's so busy with extra-curricular work.

Breitweiser frequently is a speaker at marketing, dealer, or jobber conventions. He's a member of the API's general marketing committee and of the API's Committee on Public Affairs. He is president of the Oklahoma Petroleum Council, the public-relations arm of the industry within the state; a director of the Asphalt Institute; director of Western Petroleum Refiners Association; and a trustee of Midwest Research Institute.

Broad outlook . . . The marketing arm of the business, according to Breitweiser's view, more and more is rising in importance.

This is because the No. 1 problem of the industry—and also of marketing—is oversupply.

"We have too much crude in the world. It's too great a temptation to run this crude to stills, and then we have too much products," the DX Sunray official points out. "Any school boy knows when you have too much of anything, it's tough trying to sell it at a good price. That's why oversupply also is marketing's top problem."

Breitweiser also holds definite views on other aspects of the philosophy of marketing. For example on:

. . . Divorcement of marketing. "Those who advocate that oil companies should not sell their products just aren't informed on what's best for the industry or the public."

. . . Jobbers. "We think they're important and make them a part of our team so that our relations are profitable to both of us."

. . . Dealers. "They're vital to good selling and always hard to get. This is especially true now when the soft price structure spawns price wars which discourage or keep away prospective dealers."

. . . Training programs. "You'll always have them—you can't quit."

. . . Key to success in marketing. "Any young man who goes far in this business must be able to work well with people. He must have the analytical ability to tell a good deal from a bad one. He must be well informed on general business condi-

▶ ▶ ▶ Personals

Robert H. Ossyra has been named group leader at the Seymour, Ind., laboratories of Standard Oil Co. (Ind.). He has been with the company since 1953.

L. A. Lohman, administrative superintendent at Shell Oil Co.'s Wood River, Ill., refinery, will retire August 1 after 29 years with the company. **V. G. Harrison,** administrative superintendent at Shell's Norco, La., refinery, will succeed Lohman at Wood River.

Dr. Alan Schriesheim has been appointed research associate for Esso Research & Engineering Co. Schriesheim was research chemist with the National Bureau of Standards before joining Esso.

B. N. Rolfe, supervisor of Cities Service Research & Development Co.'s exploration research division, Tulsa, has resigned to open consulting offices. He will specialize in the use of clays in secondary recovery.

Roland C. Shaw, vice president, Eastern Hemisphere, of Texfel Petroleum Corp., Dallas, has been elected president and general director of Texfel's French subsidiary, Transworld Petroleum, S.A.F. He will headquarter in Paris. Transworld is currently exploring an area in France with its French partner, Ste. de Prospection et Exploitations Petrolieres en Alsace

tions in the industry as opposed to being expert in only one phase of the industry."

...**The future.** "In spite of our problems, there's still a good future in marketing for us all—the dealer, jobber, or the company man."

From Missouri . . . Breitweiser is a native of St. Joseph, Mo., but spent most of his early days in Kansas City.

He was graduated from high school in Kansas City and attended the University of Missouri before getting his first job with Continental Oil Co. early in the depression. Breitweiser was 19 and hired on as a bookkeeper and mail boy in Kansas City.

"I told my boss I could run a posting machine," he said. "I really never had seen one; and when I sat down at that thing, it looked like the console of an organ. At the end of the first month, it took the whole department to find where I was $4.35 out of balance."

Maybe the reason Breitweiser stayed on at Continental 22 years was a transfer to marketing. In that work he clicked and over the years held positions as city manager of marketing in St. Louis, division manager at Kansas City, regional general manager in New York City, and general sales manager with headquarters in Ponca City.

During his Continental tenure, he got a taste of all phases of marketing—direct selling, jobber sales, lube oil and wax sales, and export sales.

In 1954, Breitweiser joined Vickers Petroleum Inc., Wichita, Kan., as a vice president and director. He has fond memories of those days, saying: "Being a member of a smaller company I was forced into all phases of the business, which I think helped my oil education."

He joined DX Sunray Oct. 1, 1957, as vice president in charge of all marketing activities. He was elected executive vice president of marketing January 23 this year and was elevated to executive vice president of all DX Sunray operations last May.

(PREPA). Shaw was a vice president of Foster Petroleum Corp. before joining Texfel earlier this year. He is also president of Texfel's Italian subsidiary and vice president of a Turkish subsidiary.

Victor R. Farlow has been named sales manager of Gulf Oil Corp's new petrochemical sales office in New York. Petrochemical sales office headquarters were formerly in Pittsburgh. **Robert L. Grun** has been appointed director, sales promotion and technical services; and **Sheldon E. Beadle, Jr.,** has been appointed director, market development, in the new office.

James B. Norman, senior engineer with Arkansas Louisiana Gas Co., has been promoted to supervising operations engineer in the operations engineering department, Shreveport, La. **Randall J. Aiken,** administrative assistant in the gas pipeline division, has been promoted to assistant superintendent of pipelines. **Jack B. Reidhimer,** Shreveport district meter inspector, has been transferred to Little Rock, Ark., and promoted to Arkansas division general meter inspector. **Graydon Green,** assistant superintendent of compressor stations, also moves from Shreveport to Little Rock as design engineer in meter research and development and **Billy Gene Nichols,** gas distribution engineer in the Arkansas division, has been promoted to project engineer, meter research and development, in Little Rock.

Harry E. Jacobs, director of manufacturing liaison for Atlantic Refining Co., has been appointed refining technologist for the Interior Department's Office of Oil and Gas. **Robert E. Roehl,** assistant to the transportation manager of Cities Service Petroleum, Inc., has been named petroleum transportation and storage specialist, Office of Oil and Gas.

Dr. David G. Braithwaite, vice president and a director of Nalco Chemical Co., has been named head of commercial development. **E. H. McGrew,** formerly technical director of the catalyst division, will succeed Braithwaite as general manager, catalyst division. Braithwaite joined Nalco in 1946 and has been a vice president since 1954. McGrew joined the company in 1953.

Warren N. Pearce, seismic supervisor with Texaco, Inc., has been transferred to Casper, Wyo., from Denver.

E. V. (Corky) Weaver, operations engineer for Pan American Petroleum Corp. in Wink, Tex., has been named operations and equipment engineer in Midland, Tex.

Dr. R. I. Stirton, manager of Oronite Chemical Co.'s product development department, has been named general manager of the new commercial development department. The new department will deal with both market development and market research. **Dr. W. E. Elwell,** formerly eastern manager of Oronite's product

▶▶▶ Personals

development department, has been appointed manager, market development. **K. J. Van Arnum,** product development representative in New York, will be manager of market research. **R. E. Echols,** supervisor of product development, has been named supervisor of market development. The old product development department has been absorbed by commercial development in the reorganization. Oronite is a subsidiary of Standard Oil Co. of California.

Jess Vernon, geological-geophysical coordinator for Oklahoma and Kansas with Amerada Petroleum Corp., has retired. A graduate of the University of Nebraska, Vernon joined Amerada in 1919.

George O. Morgan, geophysicist with Humble Oil & Refining Co., has been elected 1959-60 president of the Southeastern Geophysical Society, a section of Society of Exploration Geophysicists. Other new officers include **J. T. McMaster,** Pan American Petroleum Corp., vice president; **D. R. Scheel,** The California Co., second vice president; and **O. J. Rauschenbach,** Continental Oil Co., secretary-treasurer.

Jess Vernon, geological-geophysical coordinator for Oklahoma and Kansas with Amerada Petroleum Corp., has retired. A graduate of the University of Nebraska, Vernon joined Amerada in 1919. **John A. Veeder,** Midland, Tex., district geologist for Amerada, will succeed Veeder as geological-geophysical coordinator for Oklahoma and Kansas. He will headquarter in Tulsa.

John D. Forsyth, district engineer in Oklahoma City for Cities Service Oil Co., has been promoted to district superintendent of production in Great Bend, Kans. **William F. Irvin,** production engineer in Houma, La., has been transferred to Oklahoma City to succeed Forsyth. **E. L. Darby,** formerly in Lafayette, La., has been named production engineer in Houma, succeeding Irvin.

James V. Pollock, Signal Oil & Gas Co.'s Houston division engineer, has been named manager of the company's new Midland, Tex., division. Division production offices in Fort Worth and Houston will be closed and consolidated into the Midland office. **Earle T. Casler,** formerly in Fort Worth, will be Midland division engineer.

Personals

Herschel Y. Hyde, Tidewater Oil Co.'s vice president for manufacturing, has been appointed group vice president for manufacturing, marketing, and petrochemicals. He will continue to headquarter in Los Angeles. A graduate of the University of California and Massachusetts Institute of Technology, Hyde joined Tidewater in 1928 as a research chemist. He was elected vice president in charge of manufacturing for the western division in 1946 and was placed in charge of all refining operations in 1954.

D. W. Buelow, Billings, Mont., division development geologist for Phillips Petroleum Co., has been promoted to manager of the company's Anchorage division, a new position. **K. W. Calderwood,** northwest region staff geologist in Bartlesville, Okla., has been named Anchorage division geologist. He succeeds **S. P. O'Rourke,** who has been transferred to Bartlesville. In the Billings division, **W. D. Tutten,** formerly assistant division development geologist in Denver, will succeed Buelow as division development geologist. **C. F. Darling,** pool development geologist, has been promoted to assistant division development geologist. He succeeds **F. M. Tunnell,** who has been transferred to the geological engineering analysis section in Bartlesville.

N. J. Rabensburg, Jr., Ozona district geologist for Standard Oil Co. of Texas, has been transferred to Midland, Tex., from San Angelo, Tex., in a change of district headquarters. The company's western division offices have been located in Midland for many years. **B. N. Cheatham,** formerly on the division staff, has been promoted to area geologist on the district staff. Others making the move to Midland from San Angelo include **M. W. Boyce, J. C. Carlisle, C. A. Eldridge, W. P. Rogers, W. H. Thompson,** and **E. L. Vest,** staff geologists.

J. R. (Jack) Huffmeyer, formerly district geologist in Oklahoma City for Kewanee Oil Co., has been named head of a new special studies section for exploration evaluation in Tulsa. **W. R. Young,** geologist in Abilene, Tex., for Kewanee, has been transferred to Tulsa as geologist in the new group. Kewanee recently deactivated its Oklahoma City office and consolidated the Abilene and Midland, Tex., district exploration offices with headquarters in Midland.

Mark D. Leff, formerly president of Aeco Corp., Beverly Hills, Calif., has been elected president of Midwestern Oil & Gas Corp.

Charles E. Morgenthaler, petroleum engineer with Carter Oil Co. in St. Elmo, Ill., has joined Tennessee Gas & Oil Co. as petroleum engineer in Oklahoma City.

James D. Hughes, engineer with Sinclair Oil & Gas Co., has resigned to join Ashland Oil & Refining Co. in Ashland, Ky., as engineer.

P. L. DeVerter, head of the inspection laboratory at Humble Oil & Refining Co.'s Baytown, Tex., refinery, has retired. **J. C. Gorman** has been named foreman of the laboratory.

Edward E. Runyan, engineer for Sohio Petroleum Co. in Oklahoma City, has been promoted to assistant foreman and transferred to Fairport, Kans.

E. O. Buck, senior vice president of National Bank of Commerce, Houston, has been elected a director of Texas Petro Gas Co. Buck was manager of Rowan Drilling Co. before joining National Bank of Commerce in 1948.

William E. Pelley, head of the petroleum group of Bankers Trust Co., New York, has been named a vice president. Pelley was Evansville, Ind., district geologist with Sinclair Oil & Gas Co. before joining Bankers Trust in 1952.

Dr. Carroll F. Knutson has been promoted to senior research engineer in Continental Oil Co.'s production research division.

H. H. Meredith, Jr., division engineer with Humble Oil & Refining Co. in Tyler, Tex., has been transferred to Corpus Christi, Tex., as division engineer (production).

William F. Jackson, chief lineman for Sinclair Pipe Line Co. in Fort Worth, has retired after 31 years with the company.

W. E. (Bill) Little, formerly geologist with Pan American Petroleum Corp. in Bismarck, N. D., has resigned to join Baumgartner Oil Co. in Denver.

C. C. Roripaugh, geophysicist with Shell Oil Co., has been transferred to Pittsburgh from Billings, Mont. **J. K. Arbenz,** geologist, has been transferred to Denver from Billings.

H. V. Aiguier, tool pusher with Helmerich & Payne, Inc., has been transferred to Pecos, Tex., from Odessa, Tex.

J. A. Laird, Houston consulting geologist, has been named manager of the new oil and gas loan department of First National Bank of San Angelo, Tex.

George S. Kent, associate engineer in marketing operations for Standard Oil Co. of California in San Francisco, has been named junior sales engineer there.

N. L. Burkett, tool pusher in Bossier City, La., for H&S Drilling Co., Tulsa, has been promoted to drilling superintendent of the company. Burkett joined H&S in 1947 and has had field assignments in the Gulf Coast area, West Texas, and northern Louisiana. He will continue to headquarter in Bossier City.

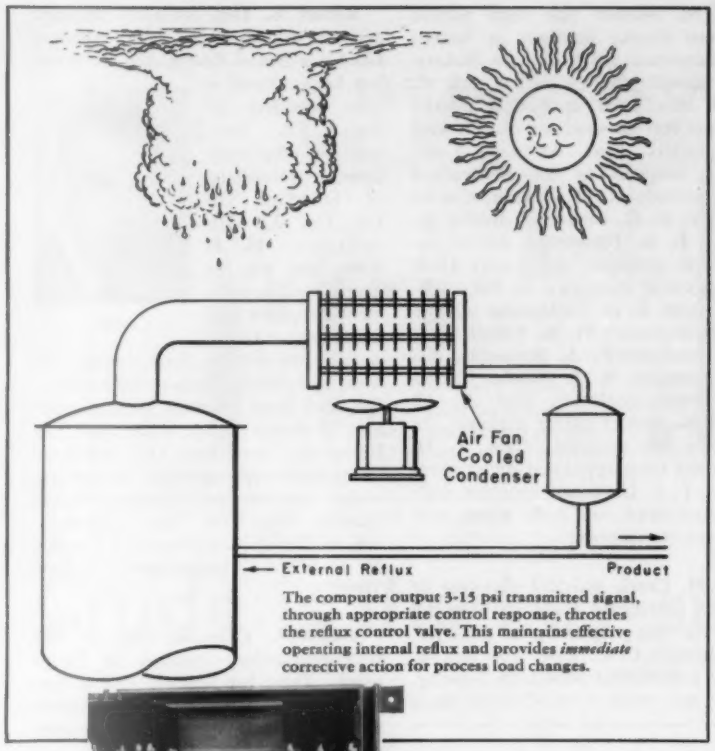
Larry McIntosh, formerly on military leave of absence, has been named engineer trainee for Atlantic Refining Co. in Odessa, Tex.

B. O. Bird, division rig superintendent for Phillips Petroleum Co., has been transferred to Guymon, Okla., from Oklahoma City.

W. L. Stevenson, exploitation engineer in Quitman, Tex., for Shell Oil Co., has been transferred to Houston as production geologist. **K. O. Williams,** exploitation engineer in Kilgore, Tex., has been transferred to Quitman in the same capacity.

A. J. Murphy, treasurer and a director of Warren Petroleum Corp., has retired. **C. J. Senger,** assistant treasurer, will succeed Murphy as a director and treasurer. Murphy joined Warren in 1927. He had been a director since 1938.

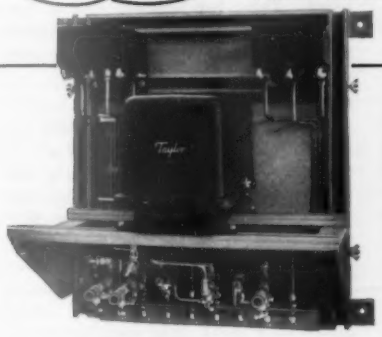
Harold Blancke, president of Celanese Corp. of America, has been named chairman. He will continue as president and chief executive officer. **George Schneider,** senior vice president, has been elected vice chairman of the company.



The computer output 3-15 psi transmitted signal, through appropriate control response, throttles the reflux control valve. This maintains effective operating internal reflux and provides *immediate* corrective action for process load changes.

FOR CONSISTENT COLUMN EFFICIENCY

...rain or shine



New Taylor Computer Control System Used by Phillips Petroleum Company

PROBLEM: Column upsets, caused by wide variations in load on the condenser due to changing weather conditions. Efficiency is reduced . . . more steam than necessary is used in reheating excessive reflux.

SOLUTION: A simple Taylor Computer Control System which instantly compensates for climatic effects on air-cooled condensers and reflux lines. This system is developed by and is licensed by Phillips Petroleum Company.

RESULTS: Phillips is delighted with the outstanding performance of this system, in commercial use on many columns. Phillips' engineers like its simplicity, and the fact that components are of the standard type with which its instrument people are accustomed. Here are some of the advantages of the Taylor Computer Control System:

1 It reduces steam consumption by the avoidance of reheating excessive reflux. The system pays for itself in a few months.

2 It provides more uniform products by smoothing out upsets at their source—particularly important on a battery of columns.

3 Not only does it give vastly improved control on columns utilizing air-cooled condensers (without the need for adjustment of air flow rate), it also pays out with other types of condensers.

4 It reduces the possibility of column flooding.

★ ★ ★

Call your Taylor Field Engineer today, or send for literature. Taylor Instrument Companies, Rochester, N.Y., or Toronto, Ontario.

Taylor Instruments **MEAN ACCURACY FIRST**

Personals

E. H. Burtner, assistant to the general manager in charge of exploration for Standard Oil Co. of California, Western Operations, Inc., has been named assistant to the vice president, exploration, for Standard Oil Co. of Texas. He will headquarter in Houston. **W. P. Winham,** Great Basin division superintendent for California Standard, will succeed Burtner. Winham will be succeeded by **M. W. Wolf,** formerly Pacific Northwest division superintendent. **E. G. Dobrick,** chief geophysicist, has been named Pacific Northwest superintendent. **J. E. McCall,** superintendent of The California Co.'s geophysics division, western region, in Denver, will succeed Dobrick as chief geophysicist for Standard of California.

Boyd McCoy, Halliburton Oil Well Cementing Co., New York, has been elected 1959-60 chairman of the New York section of AIME's Society of Petroleum Engineers. Other officers will be **Latham L. Brundred,** American Climax Petroleum Corp., vice chairman; **Shannon L. Matheny, Jr.,** Ideco, Inc., secretary; and **Fred A. Hilton,** Arabian American Oil Co., treasurer. Members of the executive committee are **William R. Waag,** Empire Trust Co.; **Gerald E. Sherrod,** First National City Bank; **Larry E. Hess,** Socony Mobil Oil Co.; and **Bryant C. Frihart,** Cities Service Oil Co.

H. M. Stanier has been named northern district manager in Sunray Mid-Continent Oil Co.'s new Bakersfield, Calif., district office. **M. C. Welch** has been appointed district manager for the southern district with headquarters near Newhall, Calif. Others assigned to the Bakersfield office include **R. M. Brazier,** district engineer; **R. G. Maynard,** district geologist; **E. A. Templeton,** district exploitation geologist; and **Leroy Hull,** district office manager. In the southern district **J. O. McDonald** will be district engineer; **M. R. Elliott,** field superintendent; **F. A. Reynolds,** district geologist; **R. J. Hindle,** district exploitation geologist; and **A. G. Goodwin,** district office manager. In Sunray's Los Angeles office, **T. H. Acres** has been appointed division engineer. **P. A. Carpenter** becomes drilling coordinator, and **J. E. Klipp,** senior reservoir engineer.

W. H. Creel, assistant manager of Phillips Petroleum Co.'s refining department, has moved up to manager. He succeeds **C. C. Tate,** who was recently named vice president, refining. Creel has been with Phillips since 1924.

Wilbur C. Kolar, technical assistant to the manager of Continental Oil Co.'s chemicals division in Houston, has been promoted to superintendent of the Trainer, Pa., petrochemical plant. He succeeds **E. W. Carlson,** who will become consultant on special problems.

Robert K. Dix, formerly assistant general manager of Esso Standard Oil Co.'s Baton Rouge, La., refinery, has been named a vice president of Enjay Co., Inc., petrochemical marketing subsidiary of Standard Oil Co. (N. J.). He succeeds **H. J. Rose,** who was recently named a vice president of Esso Export Corp.

DIX

A graduate of Iowa State College and Massachusetts Institute of Technology, Dix had been assistant general manager at Baton Rouge since 1957. As Enjay vice president, Dix will head the products management department which includes four divisions—butyl, plastics, chemicals, and additives—and the Enjay Laboratories in Linden, N. J. He will headquarter in New York.

Walter L. Crandall, assistant district production foreman in Farnsworth, Tex., for Sinclair Oil & Gas Co., has been transferred to Brookhaven, Miss., as intermediate petroleum engineer.

Burton F. Wiand, manager of Cities Service Gas Co.'s public and industrial relations division and a director of the company, has been elected vice president, public and industrial relations division. He joined Cities Service in 1952.

Deaths

John M. Miner, 41, recently named vice president of Lane-Wells Co., was killed in the June 24 crash of a Colombian Airlines plane in Peru. Miner was on an inspection trip to South American oilfields. Cause of the accident is still undetermined. Miner was president of Petro-Tech Service, C. A., in Venezuela before joining Lane-Wells.

B. T. Willey, 42, southwestern region manager of marketing for Continental Oil Co., died July 13 in a Kerrville, Tex., hospital from injuries suffered in a fall from a horse. Willey joined Conoco in 1941. He had been marketing manager in Fort Worth for the past year.

G. R. Torborg, Jr., 40, manager of economic analysis for Standard-Vacuum Oil Co., died July 12 in Chappaqua, N. Y., after a heart attack. Torborg joined Esso Standard Oil Co. in 1946 and moved to Stanvac in 1954.

Lorraine A. Tromley, 51, safety engineer for Warren Petroleum Corp. in Tulsa, was killed in a traffic accident near Inman, Kans., July 11. Tromley had recently been elected president of the Tulsa chapter of American Society of Safety Engineers and would have taken office in September.

William R. White, laboratory director of Hughes Tool Co. since 1942, died recently in a Houston hospital after an illness of several months. A graduate of the University of Oklahoma, he had been with Hughes Tool 23 years.

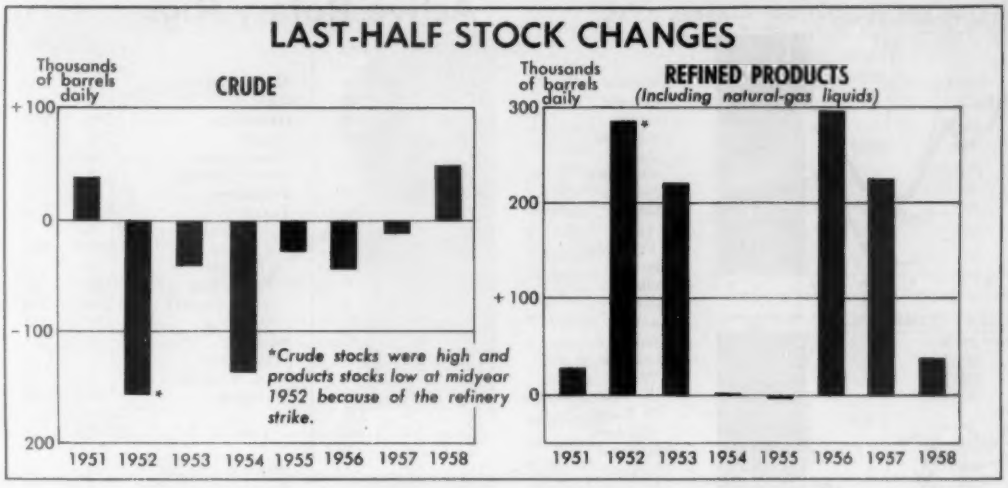
Frederick W. C. Boesch, 81, retired Tulsa independent, died July 12 in a Tulsa hospital. Boesch was active in Oklahoma, Colorado, Utah, North Dakota, and Louisiana at one time.

Fred Leon Coogan, Sr., 70, Sayre, Okla., independent operator and prominent Republican, died July 12 in Sayre.

Frederick E. (Gene) Miller, 42, superintendent of publications and employe relations for Interstate Oil Pipe Line Co., Shreveport, La., died July 10 of cancer. He had been with Interstate 13 years.

Sterling A. Germany, 53, manager of Shell Oil Co.'s Houston area land department, died July 9 in a Corpus Christi, Tex., hospital after a heart attack. He had been with Shell since 1926.

C. H. Weygint, Chanute, Kans., oil producer, died recently in a Chanute hospital after a heart attack.



Crude is the key supply factor

BY JOHN C. CASPER

THE CRUDE PRODUCTION rate for the last half of the year is important to you and your job whether you are the president of the company, a refinery worker, a tank gager, or are filling any of the hundreds of other jobs in the oil industry.

If production is too high, the unused crude will go into storage, and storage is expensive. But, this expense is not the major item. High crude inventories tend to breed excessive refinery runs. High runs create product stock surpluses. And, high product inventories put pressure on product prices.

If prices continue to drop at service-station and tank-wagon levels, the effect travels all the way back down the line to the producing well. If too much is trimmed off the selling price of products from a barrel of crude, the crude price becomes shaky.

Crude production will be the deciding factor this fall. Demand can be estimated within reasonable limits. Domestic consumption of petroleum products will be influenced by such things as total national income, automobile sales, weather, strikes, consumers' opinions of the economic outlook, military purchases, general industrial production, and even politics.

Estimates can be made of the influence from most of these factors. Even the effects of changes in weather can be covered by projecting needs on a basis of average weather and adding a safety factor to cover some of the variations from normal.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,802,325	DOWN	105,010	UP	271,485
Crude stocks	273,145,000	UP	2,775,000	UP	17,984,000
Completions	878	DOWN	319	DOWN	2
Refinery runs	7,836,000	DOWN	100,000	UP	229,000
Gasoline stocks	192,752,000	DOWN	2,237,000	UP	10,583,000
Kerosine stocks	28,494,000	UP	965,000	UP	3,454,000
Distillate stocks	125,818,000	UP	4,539,000	UP	16,311,000
Residual stocks	54,349,000	DOWN	56,000	DOWN	11,806,000
Four-product stocks	398,102,000	UP	3,211,000	UP	18,542,000
Total imports	1,398,100	DOWN	592,700	DOWN	10,900

The tricky problem in past years has been to regulate supply to a reasonable balance with demand. Crude and product storage is the surge tank to take care of the changes in market pressure, and like all surge tanks, this one has its limits.

The job of programing supply to meet demand should be easier this year than it has been in the past. Crude production is the variable this fall.

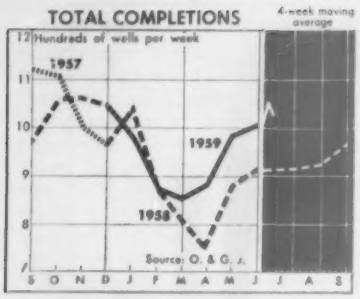
Total new supply is made up from crude production, output at natural-gasoline and cycling plants, crude imports, and product imports. A portion of gas-liquids production is tied to crude production, but the remainder can be estimated within narrow limits.

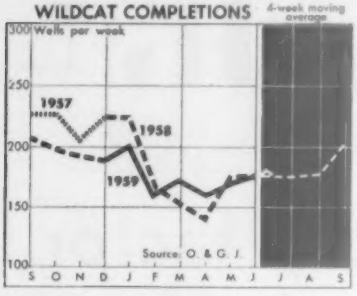
Also, limits on crude and product imports have been established by executive order. Only a small portion of the import total remains uncontrolled. These are overland crude from Canada, bunkers for ships in foreign trade, and military purchases for offshore use.

With these supply items fixed, crude production is the key item in the supply and demand balance for the last half of the year.

However, there is a good chance that past production habits will tend to boost crude a little higher than the level needed to meet demand and normal stock changes.

The Journal's forecast of supply and demand, which will appear in next week's issue, recognizes this influence and allows for it. If our crude-production estimate is higher than yours, it may be because we have posted what we think it will be and not necessarily what it should be.





Active Rotary Rigs

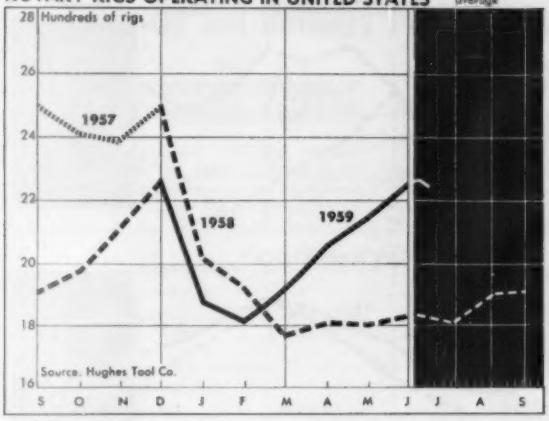
	7-13-59	7-6-59	7-14-58
Alabama	8	9	6
Arkansas	17	12	11
Arizona	1	2	0
California	93	101	78
Land	88	96	(*)
Offshore	5	5	(*)
Colorado	51	46	50
Florida	1	2	1
Land	1	1	1
Offshore	0	1	0
Illinois	41	36	56
Indiana	10	11	9
Iowa	2	2	3
Kansas	145	158	120
Kentucky	8	10	7
Louisiana	377	381	304
North	38	43	44
S. Inland waters	153	160	(*)
S. Land	130	125	214
Offshore	56	53	46
Maryland	0	0	0
Michigan	25	27	8
Mississippi	65	77	34
Missouri	1	1	2
Montana	26	24	19
Nebraska	23	36	20
Nevada	1	1	0
New Mexico	121	128	110
New York	1	1	2
North Dakota	23	20	32
Ohio	4	4	0
Oklahoma	245	243	187
Oregon	0	0	1
Pennsylvania	10	10	9
South Dakota	2	2	0
Tennessee	0	1	0
Texas	759	768	634
S. Inland waters	8	5	(†)
S. Land	199	194	126
Offshore	0	0	2
North-East	162	162	(*)
West Central	239	254	(*)
West	151	153	(*)
Utah	30	35	37
Washington	1	1	0
West Virginia	9	9	6
Wyoming	91	90	56
Total U. S.	2,191	2,248	1,802
Western Canada	141	137	142
Eastern Canada	0	0	2
Grand total	**2,332**	2,385	1,946

Hughes Tool Co. report. *Comparisons not available due to change in method of reporting. †Included in South-Land.

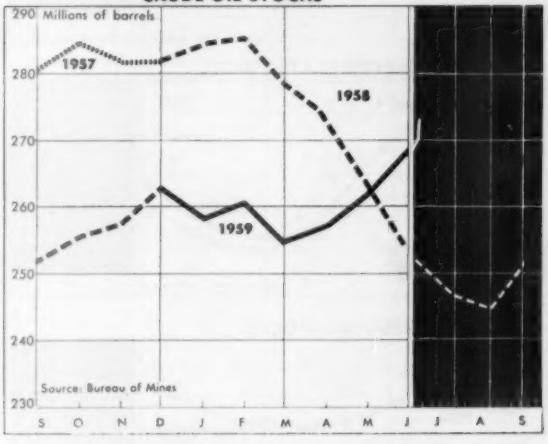
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 11, 1959

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	4	4	0	0	0	0	46,224	53	41	0	0	0	0	0	10	16
Arkansas	25	10	0	4	11	0	94,050	441	354	7	2	0	1	4	75	91
California	34	19	0	0	14	1	146,265	801	907	12	3	0	0	9	188	198
Colorado	8	1	0	1	6	0	45,399	374	392	5	0	0	0	5	223	215
Illinois	42	17	0	0	25	0	87,234	1,090	1,067	10	0	0	0	10	177	215
Indiana	22	5	0	0	17	0	34,775	408	372	8	1	0	0	7	138	140
Kansas	76	22	1	4	45	4	288,239	2,062	1,954	22	2	1	3	16	465	410
Kentucky	26	9	0	7	9	1	42,631	1,299	547	2	0	0	0	2	77	62
Louisiana	67	32	5	4	26	0	519,387	1,847	1,759	9	0	1	0	8	233	251
North	24	11	0	3	10	0	74,917	666	616	0	0	0	0	0	93	87
South	35	18	3	0	14	0	354,691	979	905	7	0	0	0	7	131	148
Offshore	8	3	2	1	2	0	89,779	202	238	2	0	1	0	1	9	16
Michigan	8	5	0	0	3	0	29,342	318	209	4	2	0	0	2	77	74
Mississippi	8	2	0	0	6	0	82,236	328	207	4	0	0	0	4	154	102
Montana	13	7	0	0	6	0	38,696	161	186	2	0	0	0	2	55	81
Nebraska	15	7	0	0	8	0	91,485	427	362	3	0	0	0	3	183	173
New Mexico	28	16	1	7	4	0	112,146	983	1,017	2	1	0	0	1	118	134
West	15	5	1	7	2	0	51,851	443	482	1	1	0	0	0	36	59
East	13	11	0	0	2	0	60,295	540	535	1	0	0	0	1	82	75
New York	20	12	0	1	0	7	26,945	149	305	0	0	0	0	0	13	32
North Dakota	5	5	0	0	0	0	32,832	265	222	0	0	0	0	0	52	72
Ohio	14	5	0	3	3	3	32,283	505	545	0	0	0	0	0	14	5
Oklahoma	99	62	2	7	27	1	384,865	3,103	3,481	5	0	0	2	3	453	483
Pennsylvania	0	0	0	0	0	0	0	311	310	0	0	0	0	0	5	9
Texas	327	196	11	18	101	1	1,376,772	10,021	9,490	62	6	3	1	52	1,847	1,959
Dist. 1	17	7	0	0	10	0	45,735	599	535	5	1	0	0	4	167	218
Dist. 2	12	4	1	5	2	0	65,685	421	405	2	1	0	0	1	120	106
Dist. 3	21	8	7	0	6	0	148,057	596	699	4	0	2	0	2	123	149
Dist. 4	14	3	0	1	10	0	80,328	671	646	6	0	0	0	6	166	187
East	17	12	0	0	5	0	79,881	584	639	2	0	0	0	2	119	183
Dist. 7-B	59	28	1	3	27	0	159,376	1,405	1,256	16	2	0	1	13	373	354
West	104	78	0	2	24	0	551,730	3,117	2,778	22	2	0	0	20	393	389
Dist. 9	62	42	0	2	17	1	152,768	1,916	1,866	4	0	0	0	4	326	317
Dist. 10	21	14	2	5	0	0	93,212	712	666	1	0	1	0	0	60	56
Utah	2	2	0	0	0	0	6,516	174	214	0	0	0	0	0	48	40
West Virginia	12	0	0	10	2	0	28,266	382	367	0	0	0	0	0	10	11
Wyoming	19	11	0	0	8	0	99,255	473	371	8	3	0	0	5	162	105
Miscellaneous	4	0	0	0	4	0	3,021	62	55	2	0	0	0	2	31	47
Total U. S.	**878**	449	20	66	325	18	3,648,864	26,037	24,734	**167**	20	5	7	135	4,808	4,925
Previous week	1,197	657	18	85	397	40	4,433,638	.....	.....	175	14	2	4	155	.....	.....
Cum. 1959	26,037	13,316	638	1,881	9,522	680	107,425,298	.....	.....	4,808	480	70	145	4,113	.....	.....
Cum. 1958	24,734	12,175	613	1,888	9,439	619	103,694,704	.....	.....	4,925	480	80	154	4,211	.....	.....
Western Canada	48	32	0	7	9	0	211,693	1,290	1,260	8	1	0	1	6	389	392
Ontario	8	0	0	1	5	2	6,049	110	.....	.....	.....	.....	.....	.....	.....	.....

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	7-4-59	6-27-59	7-5-58
Pennsylvania	2,488	2,466	2,885
Other Appalachian	2,082	2,093	1,343
Illinois, Indiana, Michigan	9,623	9,582	10,709
Nebraska and North Dakota	2,732	2,996	2,162
Kansas	10,197	10,524	9,894
Oklahoma	16,799	16,942	17,176
Arkansas	2,155	1,954	2,241
Louisiana	19,481	19,461	15,453
North	3,201	3,146	2,830
South	16,280	16,315	12,623
Mississippi, Alabama, Florida	2,604	2,391	2,053
New Mexico	8,333	8,111	6,404
Texas	117,309	116,461	105,888
East Texas	8,941	9,277	7,173
West Texas	56,333	55,615	49,248
Texas Gulf	18,986	18,945	21,733
Other Texas	33,049	32,624	27,734
Wyoming	15,800	16,363	14,930
Other Rock Mountain	9,768	9,537	8,294
California	32,926	32,862	39,462
Foreign	†20,848	18,627	16,267
Total	**273,145**	270,370	255,161

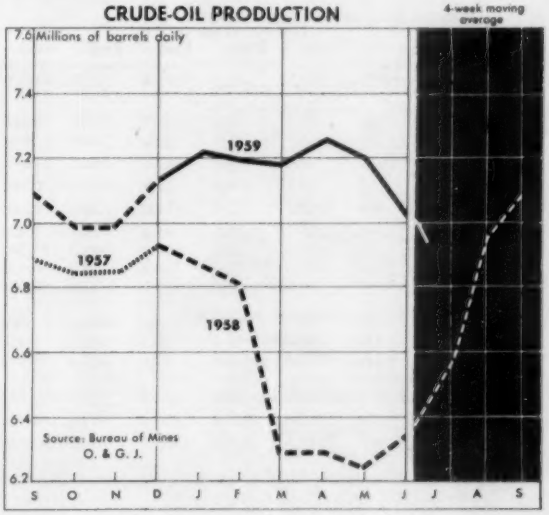
*Bureau of Mines. †Includes 5,163,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	July 11, 1959			July 4
	Crude oil	Lease condensate	Total	total
Alabama	16,150	.....	16,150	16,100
Arkansas	81,050	300	81,350	81,300
California	849,800	.....	849,800	848,100
Colorado	124,600	.....	124,600	124,100
Eastern	43,100	.....	43,100	40,800
Florida	1,200	.....	1,200	1,100
Illinois	217,000	.....	217,000	216,800
Indiana	31,400	.....	31,400	31,100
Kansas	†296,290	.....	†296,290	†306,175
Kentucky	86,500	.....	86,500	86,100
Louisiana	883,025	98,525	981,550	972,825
North	110,525	5,025	115,550	115,400
South	772,500	93,500	866,000	857,425
Michigan	26,500	.....	26,500	26,300
Mississippi	127,500	4,275	131,775	131,050
Montana	80,000	.....	80,000	78,600
Nebraska	62,500	.....	62,500	60,400
Nevada	100	.....	100	100
New Mexico	288,000	3,800	291,800	292,225
North Dakota	38,700	.....	38,700	35,000
Oklahoma	†507,500	.....	†507,500	†519,700
Texas	2,407,000	71,675	2,478,675	2,579,675
Dist. 1	43,000	2,500	45,500	45,775
Dist. 2	98,000	7,900	105,900	112,475
Dist. 3	320,000	36,000	356,000	374,300
Dist. 4	167,000	8,500	175,500	181,775
Dist. 5	28,000	350	28,350	28,925
Dist. 6	101,000	6,500	107,500	112,075
East Texas field	128,000	.....	128,000	135,425
Dist. 7-B	128,000	100	128,100	130,375
Dist. 7-C	113,000	3,225	116,225	121,375
Dist. 8	970,000	3,800	973,800	1,018,375
Dist. 9	205,000	1,800	206,800	206,800
Dist. 10	106,000	1,000	107,000	107,000
Utah	113,800	.....	113,800	114,700
Wyoming	341,800	.....	341,800	344,900
Others	‡235	.....	‡235	‡185
Total U. S.	6,623,750	178,575	**6,802,325**	6,907,335
Change from prev. week, down			**105,010**	.....
Canada	†405,356	.....	†405,356	†467,900
Total U. S. production, Jan. 1-July 11				1,374,511,290 bbl.
Same period last year (crude plus cond.)				*1,241,578,800 bbl.

*Includes 31,293,290 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota, and Washington.

CRUDE-OIL PRODUCTION



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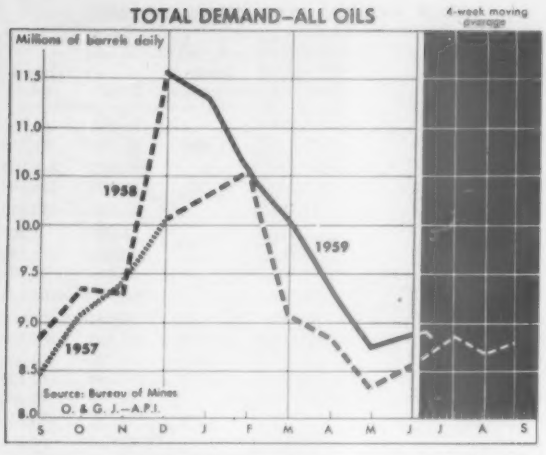

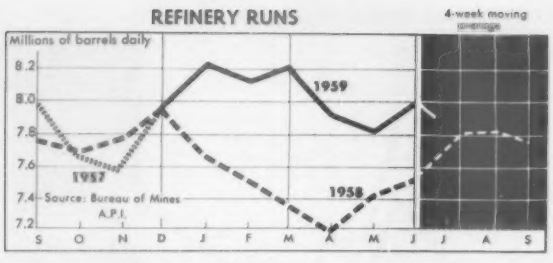

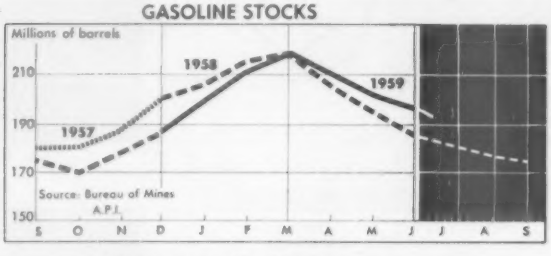

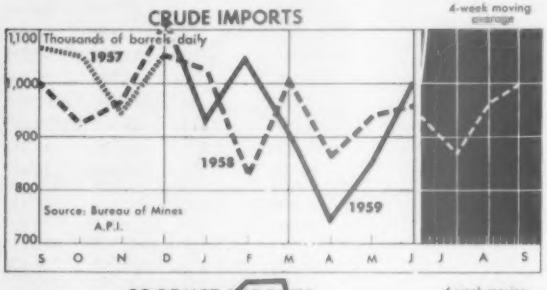

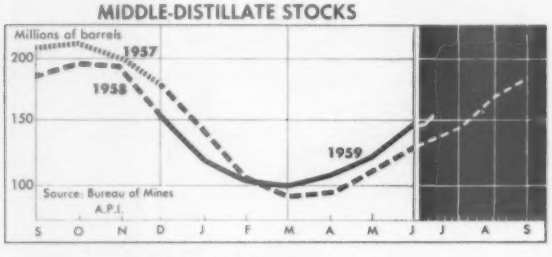

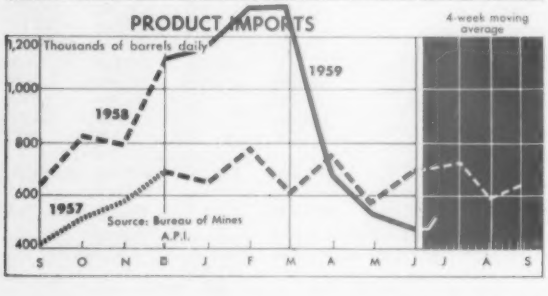

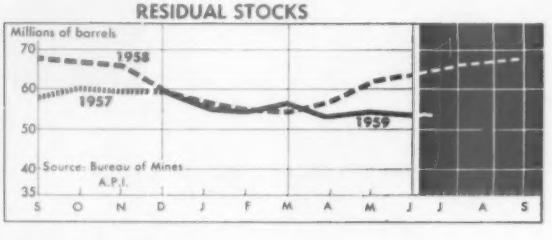

API REFINERY REPORT, JULY 10, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1958—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,075	517.7	25.3	288.8	182.0	46,033	10,744	44,381	12,301	1,093	497.9	20.1	285.4	171.9
Appalachian:														
District 1	80	41.7	2.4	20.7	0.9	5,448	592	2,668	275	94	42.2	2.5	21.6	5.8
District 2	107	56.0	5.0	22.0	8.0	2,684	583	1,228	139	108	55.4	5.7	17.3	7.3
Ind., Ill., Ky.	1,393	734.6	56.0	283.3	141.0	33,378	6,165	20,861	4,119	1,373	718.9	60.3	265.0	124.5
Minn., Wis., Dak.	111	55.3	8.6	21.9	12.3	6,596	933	5,328	387	109	53.0	5.7	28.4	10.0
Okla., Kans., Mo.	784	409.1	12.3	174.0	20.3	18,149	1,323	8,656	731	742	416.4	12.5	174.9	25.5
Inland Texas	306	226.4	5.0	49.6	24.4	7,428	332	1,661	2,078	272	192.9	5.3	45.3	18.2
Texas Gulf Coast	1,709	911.9	83.6	420.0	142.7	23,206	3,873	15,924	5,125	1,633	839.3	68.4	382.6	178.6
La. Gulf Coast	701	393.9	32.0	160.8	38.3	10,952	2,501	6,962	1,394	613	362.0	38.2	149.2	45.0
N. La. and Ark.	71	41.7	2.0	13.9	3.0	4,586	685	2,168	148	100	41.7	4.3	25.5	6.6
Rocky Mountain:														
New Mexico	25	10.7	0.3	5.4	3.1	786	46	186	109	27	13.5	0.5	5.1	2.5
Other	330	140.4	1.3	76.7	38.3	5,358	321	2,557	1,086	294	134.6	3.5	61.1	30.7
West Coast	1,144	522.6	1.1	99.6	309.4	28,148	396	13,238	26,457	1,069	485.6	5.6	150.0	284.8
July 10, 1959	7,836	4,062.0	234.9	1,636.7	923.7	192,752	28,494	125,818	54,349	7,527	3,853.4	232.6	1,611.4	911.4
July 3, 1959	7,936	3,914.6	255.4	1,824.0	954.6	194,989	27,529	121,279	54,405	.....	.....	.....	.....	.....
July 11, 1958	7,607	3,972.6	215.4	1,686.7	992.2	182,169	25,040	109,507	66,155	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (89 octane)	10.875-11.25
Premium (99 octane)	13.625-14.25

Gulf Coast (cargoes for coastwise or export movements):

★ Regular (90 octane)	10.50-10.75
★ Regular (92 octane)	10.75-11.00
★ Premium (98 octane)	11.875-12.125

California (rack) (Los Angeles):

Regular (88 octane)	12.50
Premium (94 octane)	13.50
Premium (100 octane)	15.00

Caribbean area (cargoes):

★ Regular (87 octane)	10.125
★ Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

Kerosine 42-44	9.25-9.75
Diesel oil (58 d.i. and above)	9.00-9.50
Distillate No. 1	9.00-9.50
Distillate No. 2	8.25-8.75

Gulf Coast (cargoes):

★ Kerosine 41-43	8.50-8.625
★ Distillate No. 2	8.125-8.25

New York Harbor (barges):

Kerosine 41-43	9.90
Distillate No. 2	9.40
Diesel fuel, 48-52 d.i.	9.65

Caribbean area (cargoes):

★ Distillate No. 2	8.125-8.25

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank car	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):

Residual fuel (max. 1% S)	$1.85-2.00

Gulf Coast (cargoes):

Bunker C fuel	$2.00

New York Harbor (barges):

★ Bunker C fuel	$2.27

Caribbean (cargoes):

Bunker C	$2.00

California (rack):

Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):

150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5

Pennsylvania Grade:

145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17.17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 4-1-59.

FLAT PRICES

Louisiana:

Sweet Lake	$3.00

Texas:

East Texas	3.25
Conroe	3.53
Van	3.08

Pennsylvania Grade:

Bradford	4.25
Middle District	4.07
Southwest Pennsylvania	3.80
West Virginia	3.62
Buckeye Grade	3.47

Illinois Basin 3.00

FOREIGN

Canada:

Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38

Venezuela:

Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):

Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05

Middle East, E. Mediterranean:

Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):

Seria Light, 37°	2.57

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-USNH, clean (ATRS—32.1%)	$1.94
★ Gulf-USNH, dirty (ATRS—35%)	1.85
★ Carib.-USNH, dirty (USMC—60%)	1.08

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1 SHAFFER TYPE 45, 10-¾" double gate blowout preventer; has one blank ram & one 4½" ram. $2,500.00, terms. F. H. Graves, Box 583, Ardmore, Okla., Phone 6337.

FOR SALE—One repressuring plant consisting of one Clark MA-8 compressor, three stage, 2000# discharge, 1,200 Mcf capacity. Skid mounted with scrubbers on first and second stage, also outside scrubbers. Cooling system for gas and propane storage tanks. This plant is complete and in first class mechanical condition, located in Throckmorton County, Texas. Contact Woodson Oil Company, telephone HIckman 9-2221, P. O. Box 232, Breckenridge, Texas.

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co. Inc., Dumas, Texas. Phone WE 5-5019 or WE 5-4369.

One 600 H.P. Climax V-125 12 cylinder engine and belt driven 2 stage Gardiner-Denver gas compressor with shed—all unitized, glycol dehydration and gas cooling equipment and several thousand feet of 6", 4" and 3" pipe lines and complete control equipment to handle 1.75 M³cf gas per day at 800 psi from 40 psi. All in good condition. Reply P. O. Box 311, Hammond, Louisiana.

SLIM HOLE DRILLING RIGS
Two portable 7,000 ft. Cardwell
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One National T-12 complete with drill pipe.
Attractively priced. Inventories on request.
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Bucyrus Erie 36-L skid mounted cable tool unit, complete with 4", 5½", and 6" tools.
Dog house truck mounted; rack, truck and trailer mounted. All equipment in excellent condition.
Contact: G & L DRILLING COMPANY
P. O. Box 583, Russell, Kansas
or call HUdson 3-4474 or 3-4617.

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WELL DRILLS - CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

GAS COMPRESSORS—Also small gasoline plant, pipe. Sell, lease, trade. Shut-in gas production wanted: Melvin W. Jackson, Meadows Bldg. Dallas.

FOR SALE EQUIPMENT

GAS COMPRESSORS: Clark RA-4, 400 HP; Clark RA-33, 300 HP; Ingersoll-Rand XVG-8, 330 HP; 10¼" x 10½" CD-105 Cooper-Bessemer compressor cylinders. Alfred B. Kern, 305 Kennedy Bldg. Tulsa, Oklahoma.

170 HP TYPE 80 Twin Cooper Gas Compressors, complete, dismantled for loading. $2250 each. P. O. Box 1353, Tulsa, Oklahoma.

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USED RIGS

USED Bethlehem MC-650 Rig Complete with 3—LRO Waukesha Engines . . . 8" x 18" and 8" x 16" Bethlehem Pumps . . . 7¼" x 14" G-D Pump with NKU Engine . . . 14,000'—4½" E Drill Pipe . . . 18 Drill Collars . . . Cameron B. O. Preventers . . . Steel Pits. Now drilling Southern Oklahoma.

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OIL LEASES in Kentucky—5,000 acres in Grayson County with good geology, rental due September 1, Act now. Also blocks in Breckinridge and Monroe Counties. Frank H. Patterson, Box 91, Owensboro, Ky.

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KENTUCKY
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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 3,085.88 acres of land in thirty-two parcels within the known geologic structures of various fields in Converse, Fremont, Hot Springs, Niobrara, Natrona, Sublette and Sweetwater Counties, Wyoming, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre through sealed bids on or before September 2, 1959, when bids will be opened. Details of the lease offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Blackfeet Indian Agency, Browning, Montana. Sealed Bids will be received until 2:00 P. M., Mountain Standard Time, August 12, 1959 and opened at that time in the office of the Superintendent, Blackfeet Indian Agency, Browning, Montana for leasing of 5,613.01 acres of Tribal land, 8,243.63 acres of allotted land and 160.00 acres of land in which the Tribe and individual allottees have combined interests, located in Townships 36 North, Range 6 West; 35 North, Range 7 West; 35 North, Range 6 West; 31 North, Range 9 West; 30 North, Range 8 West, Glacier County and Township 29 North, Range 8 West in Pondera County, Montana for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Blackfeet Indian Agency, at Browning, Montana.

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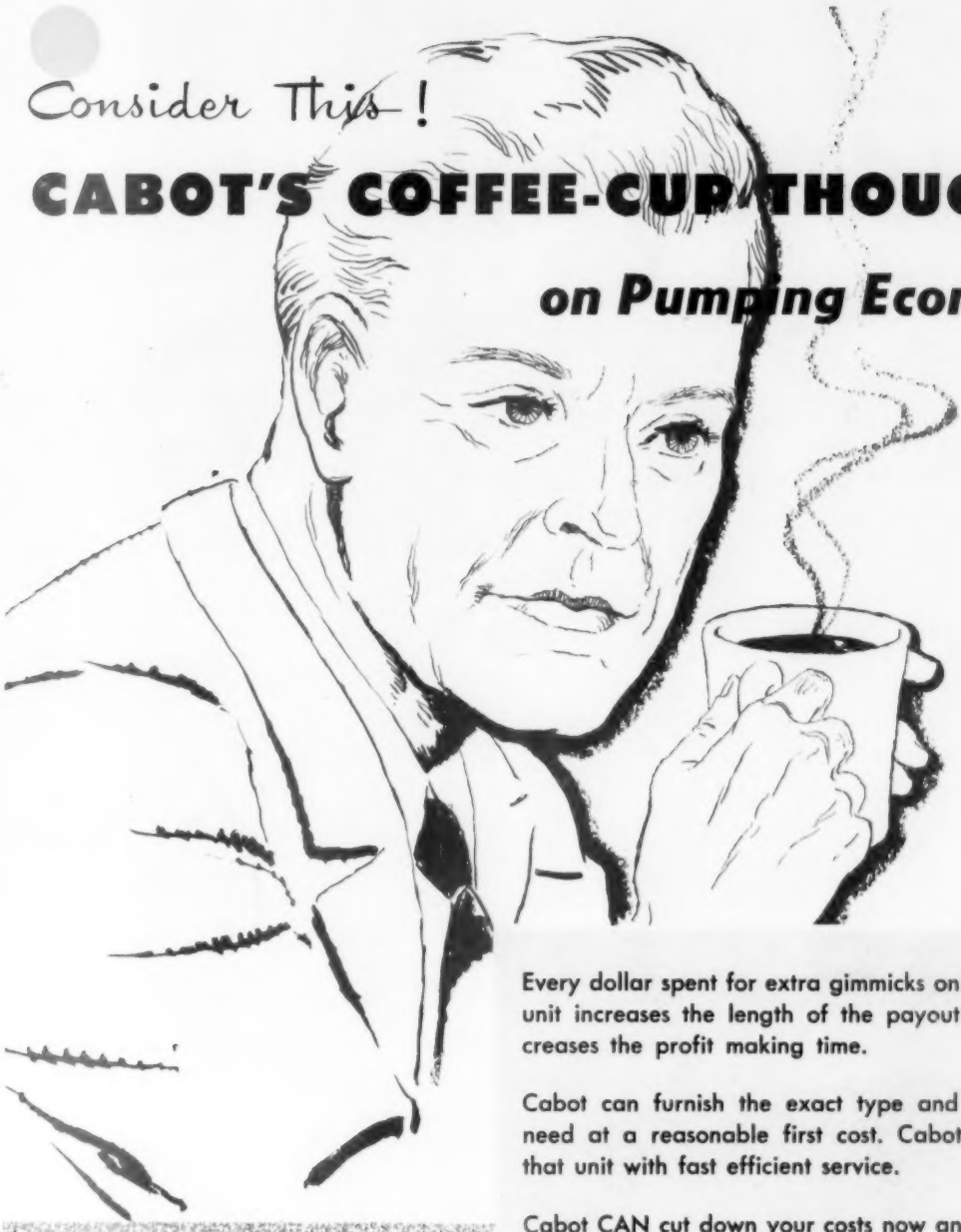

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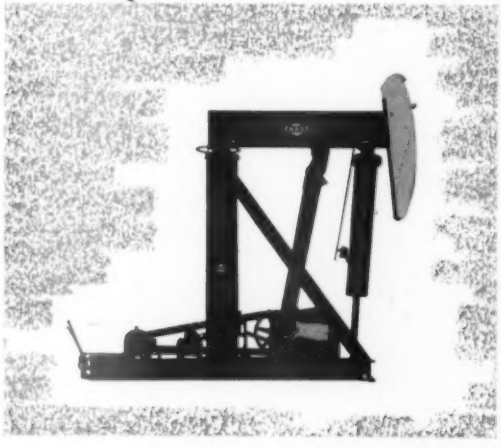

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